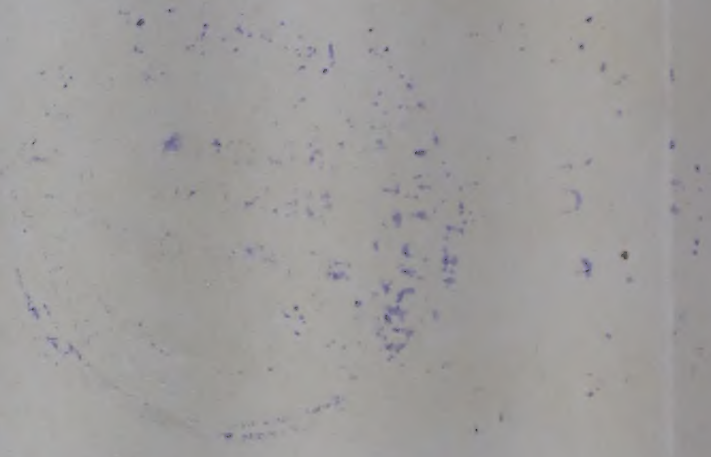

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SOUVENIR

1976

issued on the occasion of the inauguration of the permanent building of

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

COCHIN

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

On the occasion of the inauguration of Permanent Campus of the Central Institute of Fisheries Technology in Willingdon Island Cochin, by Shri. Jagjivan Ram, Union Minister for Agriculture & Irrigation on the 2nd June, 1976.

Published by

cift

Recreation Club
Cochin

On the occasion of the inauguration of Permanent Exhibition of the Central Institute of Fisheries Technology in Willingdon Island Cochin, by Shri Jagjivan Ram, Union Minister for Agriculture & Irrigation on the 2nd June, 1976.

FOREWORD

Both judicial exploitation as well as maximum utilisation of the world's fishery resources for the benefit of mankind are still under constant pursuit by all the maritime nations of the world.

The application of Science and Technology in the fishing industry has now started yielding dividends. The Central Institute of Fisheries Technology of the Indian Council of Agricultural Research has made valuable contributions in this stride during the past 18 years and they have comprehensive programme of technological research on hand for the coming years too. Today, as the Institute moves into its own new palatial permanent building at Willingdon Island, the entire staff reaffirm to dedicate themselves to the good cause of Fishery Science and Technology and to strive always to bring credit to the Institute and the Nation as well.

To mark this happy occasion, this Souvenir is brought out by the Recreation Club of the Central Institute of Fisheries Technology with the entire co-operation of the club members, the souvenir committee in particular and many well wishers, to whom thanks are due in great abundance.

Sd/-
R. BALAN
President
C. I. F. T. Recreation Club

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"Scientific vigilance and vision would be needed to maximise the beneficial effects and minimise the negative consequences of new technology.

Scientific advances should be exploited for production advance which in turn should be converted into rural prosperity".

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DY. DIRECTOR GENERAL
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(Fisheries)
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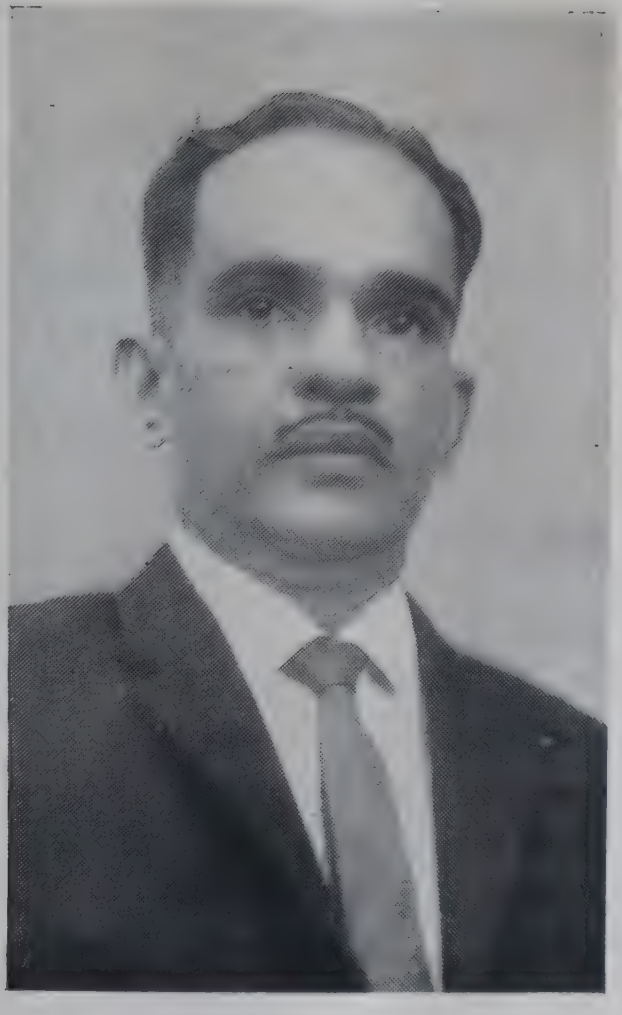
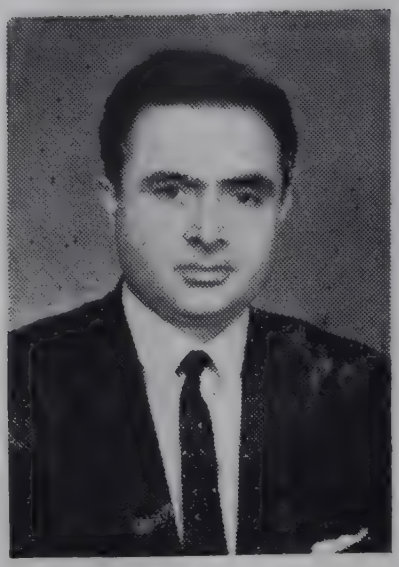
Dr. A. N. Bose
First Director (1961-1968)
21-4-'61 — 16-7-'68



Late Dr. V. K. Pillai
Director (1970-1972)
12-1-'70 — 5-12-'72



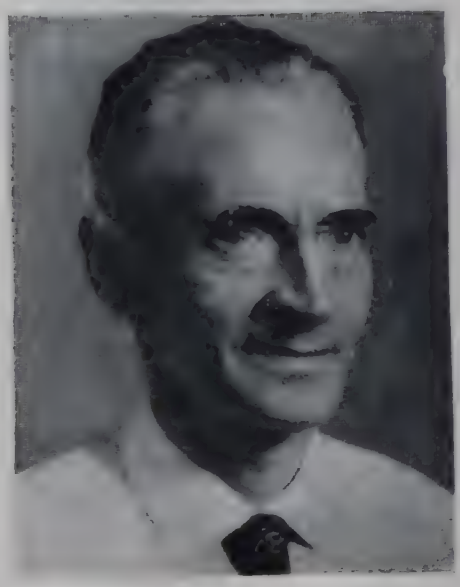
Dr. S. Z. Qasim
Director 17-1-'73 to 4-1-'74

Dr. R. V. Nair
Director 4-1-'74 to 2-9-'74

Shri. G. K. Kuriyan
Present Director 3-9-'74

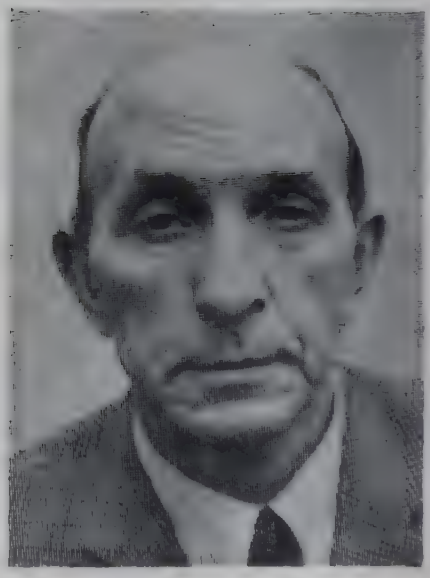
FOREIGN EXPERTS ASSOCIATED WITH THE DEVELOPMENT OF CIFT

Dr. Hideaki Miyamoto
F. A. O. Fishing Gear Expert



Paul B. Ziener
F. A. O. Naval Architect

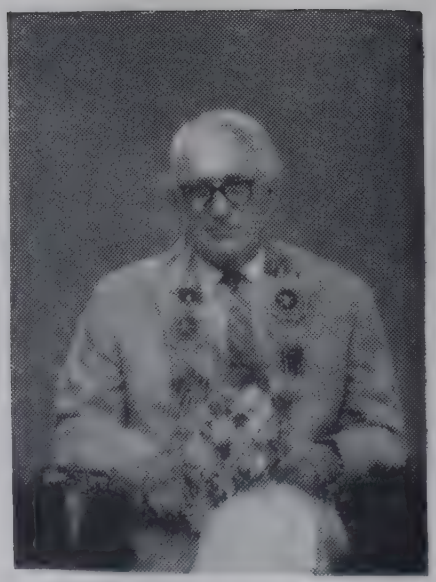
Peter Gurtner
F. A. O. Naval Architect



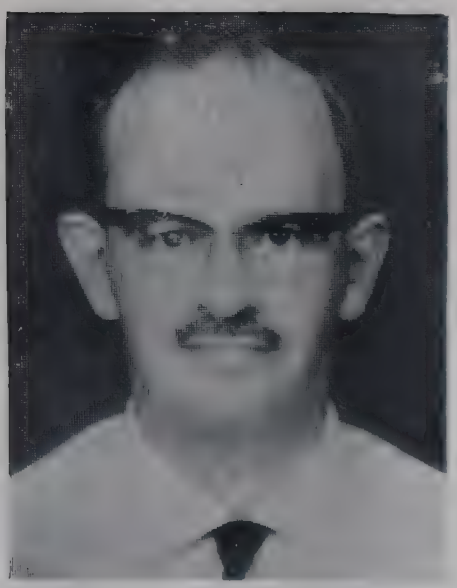
A. Sutherland
F. A. O. Marine Engineer

E. Kvaran
F. A. O. Marine Engineer

Capt M. Nakai
Colombo Plan Shrimp Trawl Expert



Dr. S. A. Beatty
F. A. O. Fish Processing Expert



C. G. Tucker
F.A.O. Expert in Freeze Drying

SCIENTISTS TRAINED ABROAD

	Training Period	Country visited	Field of training
Dr. V. Krishna Pillai	1962 6 months	Canada	Inspection and quality control of fishery products
Shri. G. K. Kuriyan	1963-64 6 months	Japan	Gear technology
*Shri. R. L. Roy Choudhury	1963-64 6 months	United Kingdom	Design and construction of fishing vessels
*Shri. P. V. Kamasastri	1964-65 6 months	Japan	Utilisation of fishery waste
Shri S. D. Deshpande	1964-65 6 months	Japan	Gear technology
Shri. H. N. Mhalathkar	1964-65 1 year	Denmark	Power fishing from small boats
Shri. C. V. N. Rao	1965-66 6 months	United Kingdom	Instrumentation in fish processing technology and research
Shri. S. Gopalan Nayar	1965-66 9 months	USSR	Fishing, gear design and fisheries techniques
Shri. V. C. George	1965-66 9 months	USSR	Fishing, gear design and fisheries techniques
Shri. A. V. V. Satyanarayana	1966 3 weeks	USSR	Instrumentation and methodology in fishing technology
Shri. K. A. Sadanandan	1967 3 weeks	USSR	Fish behaviour in relation to fishing

*Since left the Institute

Dr. K. Ravindran	1969-73 3 years	Belgium	Chemistry as applied to fishing craft materials
Shri. K. Mahadeva Iyer	1969 6 months	Japan	Microbiological aspects of fish preservation
Shri. M. Rajendranathan Nayar	1971 6 months	United Kingdom	Fish proteins and enzyme chemistry
Shri. Cyriac Mathen	1971-72 1 year	Norway	Fish processing technology and quality control
Shri. C. P. Verghese	1971-72 1 year	Norway	Gear technology
Shri. Manohar Doss	1973-74 1 year	Norway	Gear technology
Shri. V. Vijayan	1973-74 1 year	Norway	Gear technology
Shri. N. A. George	1975 5 months	United Kingdom	Deep sea trawling
Shri. P. Sulochanan	1975 6 months	USSR	Reservoir fishing

OUR INSTITUTE AND ITS REGIONAL CENTRES

Central Institute of Fisheries Technology
Willingdon Island, COCHIN - 682003.
KERALA.

Phone 6845 (10 lines)
Director 6880
,, (Residence) 35263
Administrative Officer 6839

Central Institute of Fisheries Technology Sub-station,
Bunder Road, VERAVAL-362265.
GUJARAT.

Phone 297
Officer-in-charge Res. 597

Central Institute of Fisheries Technology Sub-station,
Mangaraju Building, KAKINADA-533002
ANDHRA PRADESH.

Telephone 236
Officer-in-charge Res. 1028

Central Institute of Fisheries Technology Sub-station,
BURLA-768017, Sambalpur Dt.,
ORISSA.

Telephone 19

Central Institute of Fisheries Technology Unit,
Beach Road, West Hill,
CALICUT-673005.
KERALA.

Telephone 76607

Central Institute of Fisheries Technology Unit,
18th June Road, St, Inez, 2nd Floor, Shanta,
PANAJI-403001,
GOA Telephone 2049

Central Institute of Fisheries Technology Unit,
162, B. P. T. Godown, Sassoon Dock,
COLABA, BOMBAY-400005.
MAHARASHTRA. Telephone 213892

Central Institute of Fisheries Technology Unit,
C/o. Inshore Fishing Station,
62, C.S.N. Chetty Street, Royapuram,
MADRAS - 600013.

Central Institute of Fisheries Technology

ORIGIN AND DEVELOPMENT

In the pre-independant era fisheries research and development in India were the responsibilities of the then provinces and states. In addition some work, mostly biological in nature, were carried out in certain universities. Early 1947 witnessed the establishment of two centrally organised research institutes, the Central Marine Fisheries Research Institute and the Central Inland Fisheries Research Institute which took upon themselves the task of conducting biological research on marine and inland fisheries respectively. But for a small wing attached to Central Marine Fisheries Research Institute for conducting research on fish processing technology, there remained a big gap in the organised fisheries research programmes devoted to technology, particularly, research on fishing craft and gear, which remained a neglected field.

The proposal for the establishment of a Central Fisheries Technological Research Station was first made by the Fisheries Research Committee headed by B. N. Chopra, the then Fisheries Development Adviser, and constituted by the Ministry of Food and Agriculture, Government of India in 1954. In their report submitted in August of the same year the committee recommended: ".....for the full development of fisheries industry in the country we are, however, convinced that there is a real and urgent need for undertaking technological work. The research work on technological problems now underway in a few states is mostly on problems of local interest. Technological research, to be of real value, should, however, be planned on a broad and All-India basis and carried out in an intensive manner. It should include craft and gear technology, food technology and technology of bye-products. We, therefore, recommend the establishment of a Central Fisheries Technological Research Station at some suitable centre. The planning of such a Station and its programmes in the initial stages is work that can best be done by an experienced fishery technologist. We, therefore, further recommend that the Fisheries Division of the Food and Agriculture Organisation at Rome be approached for advice of their Chief Technologist in planning the Station and the initial programme of work". The recommendation was accepted by the Government of India and in turn approached FAO for technical assistance to set up the proposed Station. Under their Expanded Technical Assistance Programme FAO assigned the services of Dr. Hideaki Miyamoto, (formerly Chief of Fishing Gear Section of Tokai Regional Fisheries Laboratory, Tokyo) as the Gear Techno-

logist to this Country. He jointly with Shri. G. K. Kuriyan*, the newly appointed Assistant Director (Gear) submitted to the Government of India 'A scheme for Organisation of the Central Fisheries Technological Station Gear and Craft Wing'. Based on their recommendations the Central Fisheries Technological Research Station was set up in December, 1957 at Cochin with a small nucleus of staff for conducting research work on fishing craft and gear. The Station was housed in three rooms set apart at the Offshore Fishing Station, Cochin.

The organisation of the Processing Wing of the Station was little more delayed owing to the difficulty experienced by FAO in recruiting a suitable expert. Finally Dr. Ernest Hess, the Chief of the Technology Branch of the Fisheries Division, FAO came over to India and after assessing the position prevailing in the country submitted his 'Report to the Government of India on the Organisation and operation of a Central Fish Processing Research Laboratory' in May 1958. In formulating his report Dr. Hess had considered the relation of the proposed processing research laboratory to the gear and craft research wing of the Central Fisheries Technological Research Station. In his report he had also outlined the organisation and operation of Quality control and Inspection service and a Fisheries Technology Extension service. Based on and in line with his recommendations the Processing Wing of the Station was started in 1958 and the Extension, Information and Statistics Wing was added in 1961. In 1962 the Institute was rechristened 'Central Institute of Fisheries Technology' and the head of the Institute redesignated as Director. Another important landmark in the development was that in October, 1967 the Institute together with two other Central Research Institutes for Fisheries was brought under the administrative control of the Indian Council of Agricultural Research to provide greater autonomy and an atmosphere more conducive to research, on a decision of the then Ministry of Food, Agriculture Community Development and Co-operation.

Ever since its inception the Institute has gone on record as registering slow, but steady growth. The Institute was expected to take initiative in surveying and defining the problems of the industry on a nation-wide basis and to deal with basic and applied research problems common to all maritime states. Wherever problems of purely regional characteristics existed the Institute was to establish its substations as recommended by Dr. Hess in his report. This was necessitated and the Institute had to open its substations or units in different States to tackle problems either in craft and gear or processing or both.

During the course of its development the Institute has had the provilege of receiving assistance of the FAO from where experts in various fields of fishery technology were deputed for imparting comprehensive practical training to their Indian counterparts. They included Dr. Hideaki Miyamoto, Fishing Gear expert, Paul B. Zeiner and Peter Gurtner, Naval Architects, James Griffin, A. Sutherland and E, Kvaran, Marine Engineers, and Dr. S. A. Beatty and C. G. Tucker, Processing Experts. The Institute has also been recognised as a competent centre of learning and for imparting theoretical as well as practical training in all the important aspects of fishery technology including fishing craft, gear and fish

*formerly Assistant Director of Fisheries (Craft & Tackle) of the Department of fisheries, Madras.

processing. Not only the maritime states of India, but also institutes from abroad made use of the facilities by deputing their departmental candidates for undergoing training at the Institute. Officers from countries like Africa, Philippines, Zanzibar etc. had thus received training at the Institute either under the Colombo Plan or under F. A. O. fellowship. In collaboration with the Indo Norwegian Project and the F. A. O. of the United Nations, the Institute had organized comprehensive trials and tests of craft and gear and training of personnel under the programme of Development of Beach Landing and Surf Riding Fishing Boats at selected locations along Indian coast. These courses used to be regularly conducted at the Institute until the establishment of Central Institute of Fisheries Education, Bombay and Central Institute of fisheries Operatives Cochin / Madras.

A regular course of refresher training extending for 15 to 30 days duration, intended for imparting advanced training to candidates sponsored by the fishery industrial units was initiated in September 1973. So far about 200 candidates were trained in various fields under this programme.

This Institute has been recognised by the Universities of Kerala, Cochin, Bombay and Gujarat for carrying out research leading to the award of post-graduate and Doctorate Degrees.

The processed marine products exported from India today have established a name of their own in the world markets thanks to the high standards of quality they maintain. The role played by this Institute in bringing about this good name is none the less. The Institute had, since very early days, rendered yeoman service to the fish processing industry in order to instil in it a supreme consciousness towards maintenance of high quality standards acceptable to buyers abroad and for this purpose the Institute undertook a regular voluntary inspection scheme. It has mostly been responsible for drafting the quality standards laid down by the Indian Standards Institution for most of the processed fishery products. When the Government of India introduced the CompulsoryPre-shipment Inspection for the fishery products meant for export in 1965 it was this Institute that was vested with the task of implementing that. The Institute has gone on record as having had introduced a streamlined inspection programme and smoothly running it until 1969 when, on the basis of a policy decision by the Government of India the scheme was transferred to the Export Promotion Council.

All establishments of Central Institute of Fisheries Technology. the Headquarters laboratories as well as Sub-stations and Units have been accomodated in rented buildings, perhaps with the exception of its Unit at Calicut which, though started functioning in a rented building, was later shifted to the building of the Sub-station of the Central Marine Fisheries Research Institute. A great dream long cherished has come true with the inauguration of this permanent building at Cochin facilitating the Institute to bring its different sections spread over in different places in Cochin under one roof and thus widen its activities and be of better service to the nation.

OBJECTIVES OF THE INSTITUTE

The Central Institute of Fisheries Technology was set up at a time when the fishing and fish processing methods prevalent in the Country, besides being far less than adequate, were highly outdated. Traditional country crafts and gear with limited fishing ability were in use. Fishing activities were restricted to a narrow coastal belt leaving the rich offshore and deeper waters almost virgin. There prevailed an atmosphere of greater awareness towards the need for sustained increase in fish production both from marine and inland sources. The potential of marine products processed on modern lines like canning and freezing as great foreign exchange earners was becoming increasingly appreciated. Therefore, there was need for a thorough overhaul of the set up in fishing and fish processing industries. For this, newer types of gear and accessories operable in deeper waters were to be designed so also the craft required to operate them from and to suit the country's requirements. The infant fish processing industry coming into vogue on modern lines had to be helped out of their problems besides working out newer and easier methods for proper utilization of the catch, which called for development of better and more modern techniques and equipments for storage, transport and preservation. It goes without saying that such a revolution in the fishing and fish processing industries cannot but be made with the full backing of know-how developed out of research carried out in specific fields. Further, there required a machinery for reaching the research results to the fishermen or processor and educating them about the modernisation in processes and products that can be brought about as a result of adaptations of the techniques developed in laboratory. The activities of the Central Institute of Fisheries Technology are oriented towards fulfilment of these objectives outlined and the framework within which the Institute aims to function can be summarised as below.

A) *RESEARCH*

1. Increased fish production.

A steady increase in fish production commensurate with the increased demand as human food and raw materials for fish processing industry can be achieved only by evolving better designs of fishing vessels suitable for Indian waters and adoption of more efficient catching techniques and implements. The investment in fishing operations and the effort put in should guarantee a reasonable and attractive return to the entrepreneur. Research on these aspects is one of the objectives of the Institute.

2. Utilization of fish catch.

Fish is a highly perishable commodity and right from the moment it leaves the

waters it is prone to subject itself to a variety of changes leading to spoilage and unacceptability for human consumption. Optimum utilization of landed catch thus forms an integral part of any scheme for proper exploitation of fisheries. By its intrinsic nature fish poses several problems in storage, transport, preservation and processing into different types of products, the solutions for which have to be found by a systematic research, commencing from the preliminary aspects like the causes of spoilage, changes occurring during spoilage, effects of different treatments on nutritive value and consumer acceptance of preserved products etc. Problems of both short and long term preservation are to be investigated. Methods and machinery should be developed especially for processing different types of fish products suitable for home as well as export markets.

Processing of fish invariably produces waste material, which, when judiciously utilised for formulation of byproducts, can add to the overall income from the industry. Wastes like "trash" fish, fish offal, body oil, shell etc. will have to be utilised as the base for a variety of products and suitable methods developed.

3, Import substitution.

The existing fishery industry, not being organised on modern lines, had and to a certain extent still continues to depend on a variety of imported components by way of materials and equipments required both on the fishing and fish processing sides. An industry as vast as fisheries cannot all the time depend on imported components for its maintenance and this calls for intensive studies on several aspects with a view to import substitution and to ensure better economic returns.

B) *TRAINING*

Development and expansion of the fishery industry in the country depend on how and to what extent it makes use of the best of modern technology avaiable for its benefit. Most of the results of research evolved towards modernisation of the industry could better be utilised on commercial scale operations only by specially trained personnel. A programme of such training of personnel of the industry forms another objective of the Institute.

C) *EXTENSION AND EDUCATION*

The results of research can find themselves manifested only if they reach the ultimate benefactor in a way and style acceptable to and implementable by him. In appreciation of this aspect the Central Institute of Fisheries Technology added an Extension service in its activities from as early as 1961.

ORGANISATIONAL SET UP OF THE CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

The Central Institute of Fisheries Technology is headed by a Director in whom rest all the administrative powers with regard to research and running of the Institute. He is helped in formulating and evaluating the research projects and programmes of the Institute by three consultative bodies, *viz.* Project Advisory Committee, Staff Research Council and Management Committee. Project Advisory Committee and Staff Research Council are constituted from among the staff of the Institute, while Management committee has membership on a wider basis including those from different State Governments, Agricultural Universities etc. apart from the staff representatives of the Institute. In administration he is assisted by a Senior Administrative Officer and an Accounts Officer.

RESEARCH AND DEVELOPMENT

The Research and Development activities of the Institute are carried out at the Headquarters in its following Divisions and Sections under them.

I. **Craft Division**:
   1. Craft materials
   2. Craft designs.

II. **Gear Division**:
   1. Gear materials.
   2. Gear design.
   3. Fishing methods

III. **Biochemistry, Nutrition and Microbiology Division**:
   1. Biochemistry.
   2. Nutrition.
   3. Microbiology

IV. **Processing and Packaging Division**:
   1. Freezing.
   2. Canning.
   3. Dehydration.
   4. Quality control.
   5. Byproducts.

V. **Engineering Division**:
   1. Marine engines.
   2. Instrumentation.
   3. Process engineering.
   4. Pilot plant and service.

VI. **Extension, Information and Statistics Division**:
   1. Extension and Information.
   2. Statistics.
   3. Training.
   4. Testing laboratory

Research investigations are carried out in the first five Divisions and the Statistics section of the Extension, Information and Statistics Division.

1. The Craft Division undertakes investigations towards evolving cheap construction material for fishing boats in place of conventional costly timbers like teak and copper and brass fastenings

and fittings; finding out suitability and efficiency of materials other than wood for construction of fishing boats, evolving efficient measures for protection of fishing boats and components against marine deterioration and introducing suitable designs of boats for offshore and deep sea fishing.

2. The Gear Division undertakes studies towards comparing and establishing the relative merits and demerits of different natural and synthetic fibres for fabrication of fishing gear, evolving efficient methods of preservation of fishing gear against marine deterioration and working out quality standards for different types of gear materials. Investigations towards evolving improved and new designs of fishing gear, standardising the type and size of the gear for different sizes of vessels and for different types of fishes and evolving better techniques in fishing for maximum exploitation of a particular species are some of the other items of work taken up by this Division.

3. The Biochemistry, Nutrition and Microbiology Division undertakes investigations towards assessment of nutritive values and chemical composition of different types of fish, nature and extent of spoilage brought about in fish and processed fish products under different conditions of preservation and storage, changes in chemical constituents and nutritive value under different conditions of preservation and storage, enzyme systems in fish and the nature and extent of postmortem changes in quality brought about by them and isolation of useful chemical constituents of fish. The Division also undertakes investigations on the nature and extent of bacterial flora in different types of fish, nature and extent of micro-organisms introduced into fish due to terrestrial contamination, the changes brought about in quality of fish and fish products by the action of these micro-organisms, the extent of prevention of bacterial growth and multiplication under different methods of preservation, pathogenic organisms encountered in fish, source of their contamination and methods of prevention, development of efficient methods of detection and enumeration of different types of bacteria encountered in fish and fish products and development of suitable culture media for specific types of organisms and microbiological methods of determination of vitamins in fish and fish products. Investigations are also undertaken towards working out general guidelines as to preservation of fish by icing and precautions to be taken on board fishing vessels, preprocess centres and processing factories in order to retain maximum quality and avoid wastage due to spoilage.

4. The Processing and Packaging Division undertakes investigations towards working out efficient methods of preservation and processing suited to individual type of fish, standard methods for processing fish by freezing, canning, dehydration, accelerated freeze drying, curing and smoking, assessment of the nature and extent of quality losses in fish products under different conditions of storage, development of methods for production of diverse products from fish, methods of preparation of ready-to-serve convenient foods and development of methods and machines with a view to economising production and improving quality of processed products. The Division also undertakes studies towards effective methods of utilisation of processing factory wastes and trash fishes, improvement in the methods of preparation and utilisation of different types of fish,

byproducts like fish oil, shark fins, fish maws etc.

Quality assessment of different types of processed products, advice on maintenance of proper sanitary and other conditions in processing establishments to turn out products conforming to the quality standards laid down by the importing countries are also the work of this Division.

5. The Engineering Division undertakes studies towards working out quality standards for selection of marine engines for different sizes of boats and different types of fishing, developing suitable deck equipments for use in different methods of machanised fishing, development of electric and electronic instruments for testing and measuring purposes both in research investigations and commercial fishing and testing of indigenously manufactured marine engines for assessing quality and suggesting improvements. Development of equipments and machineries required for fish freezing and canning industries, fish handling, fish storage and operation of pilot plants, also come under this Division.

6. The Statistics Section of the Extension Information and Statistics Division undertakes investigations on such of the problems of the industry which require collection, compilation, analysis and interpretation of statistical data towards economising production avoiding wastage and improving quality of processed products. The Extension and Information section functions as a liaison between the Institute and the fishery industry in popularisation of the technical know-how among the actual users and detection of problems in the field. The section also undertakes testing of materials and products offered by the fishery industry for quality evaluation and advice towards improvement.

In addition to undertaking the various research activities detailed above, the Headquarters of the Institute function as one of the centres for executing the research programmes under the 'Utilization of Trash Fish' part of the All India Co-ordinated Research Project on 'Transportation of Fresh Fish and Utilization of Trash Fish' launched by the Indian Council of Agricultural Research. This is also the co-ordinating centre for the above project. Another Interinstitutional research project on 'Production and Utilization of Chitosan and allied products from prawn shell waste' which the Institute has drawn up to be executed in collaboration with Cotton Technological Researh Laboratory, Bombay and the Bombay Textile Research Association, Bombay has been sanctioned by the Indian Council of Agricultural Research.

The Institute has set up its various Sub-stations and Units located in different parts of the country. They take up their own research projects and programmes based on the needs of the existing fisheries and the potential ones in the locality or the region.

1. Sub-station, Veraval (Gujarat State).

Set up in 1962, the work of the Sub-station covers the problems in the fields of Gear and Processing. The Sub-station undertakes investigations towards evolving improved and new fishing gear and methods for optimum exploitation of the commercially important fisheries of the zone like prawns, pomfrets, hilsa, dara, ghol, Bombay duck etc. Development of processing methods suited to individual species, particularly by canning, freezing, dehydration and curing are undertaken in

Processing wing of the Sub-station. The Sub-station is also one of the two main centres for the implimentation of research work under the Transportation of Fresh Fish part of the All India Co ordinated Research Project on 'Transportation of Fresh Fish and Utilization of Trash Fish'.

2. Sub-station, Kakinada (Andhra Pradesh).

This Sub-station also was set up in 1962 with the primary intention of introducing commercial trawling from small and medium sized vessels for the exploitation of the prawn resources of the region and evolving standard designs of trawl nets and otter boards for operation from different sizes of vessels. Development of fishing gear and methods suitable for exploitation of the fishery resources of the east coast also forms part of the activities of the Sub-station. This Sub-station is the other centre for operation of the Co-ordinated Research Project on 'Transportation of Fresh Fish'. With the initiation of studies relating to the problems of fresh fish transportation from this centre a Processing section started functing at this Sub-station since 1972

3. Sub-station, Burla (Orissa State).

This Sub-station was set up in 1963. This is the only Sub-station of C I F T devoted to work on development of gear suitable for inland fishing, particularly reservoir fishing.

4. Unit, Nangal (Punjab).

This Unit was established in 1964 to develop gear suitable for fishing the apparently sparse fish population of a deep reservoir like Gobindsagar. After successfully completing the work assigned to the Unit and submitting necessary recommendations to the concerned State Fisheries Department (Himachal Pradesh), the Unit was closed down towards the end of 1970.

5. Unit, Panaji (Goa).

This unit was established in 1964. Introduction of commercial trawling for prawns and studies on purse seining for the extensive pelagic fisheries population of mackerel and sardine are the principal functions of the Unit.

6. Unit, Bombay (Maharashtra State).

This is the earliest established among Sub-stations and Units of the Central Institute of Fisheries Technology. Established in 1958 the Unit was entrusted with the task of tackling the specific technological problems connected with the freezing and frozen storage of commercially important fishes of the region *viz.* pomfrets, jew fish, eel, dara, ghol, Bombay duck etc. The Unit is also a sub-centre for the All India Co-ordinated Research Project on 'Transportation of Fresh Fish'

7. Unit, Calicut (Kerala).

This Unit was set up in 1962. Problems faced by the curing industry in the region attract the immediate attention of the Unit. Improvements of the existing methods of curing employed by the industry with a view to turning out products of better appearance and longer storage life with respect to different types of fish, oily and non oily, are the main projects undertaken by this Unit.

8. Unit, Madras (Tamil Nadu).

Although the Institute does not have a Unit in its strict sense at Madras, three scientists have been posted there at the request of the Tamil Nadu Government to help in their inshore fishing programmes.

New Units at Nagarjunsagar in Andhra Pradesh, Bhavanisagar in Tamil Nadu, Rihand in U. P. and Calcutta in West Bengal, the first three for studies on reservior fishing and the last one for estuarine fishing, have been sanctioned and will be commissioned soon.

LIBRARY FACILITIES.

The library at Headquarters has got a collection of over 2000 books on 16 major and allied subjects. It subscribes to more than 70 scientific journals regularly. There is no separate library at Sub-stations and Units. At present their requirements for books and journals are met by sending by post the required books from the Headquarters for reference and getting them back. Also a list of useful papers appearing in different journals is prepared at the Headquarters and circulated among the Sub-stations and Units so that the scientific personnel there can request for the journal containing papers of their interest. There is also a Xerox machine available at Headquarters which facilitates to send the full text of papers of particular interest without risking the safety of the original publication sent by post.

ADMINISTRATION

The administrative control of the Institute is effected through two wings. One headed by the Senior Administrative Officer, deals with the matters connected with recruitment, service policy, discipline, vigilance, staff welfare, land and buildings, budget, expenditure, stores and purchases; and the other headed by an Accounts Officer, deals with accounts and internal audit.

The administrative control of the various Sub-stations and Uuits also rests with the Headquarters. However, the day to day administration of the Sub-stations and Units is the responsibility of the Officer-in-charge of the Station concerned. Ministerial assistance has been provided at all the Sub-stations and Units for this purpose.

★

The only Magic to Remove Poverty

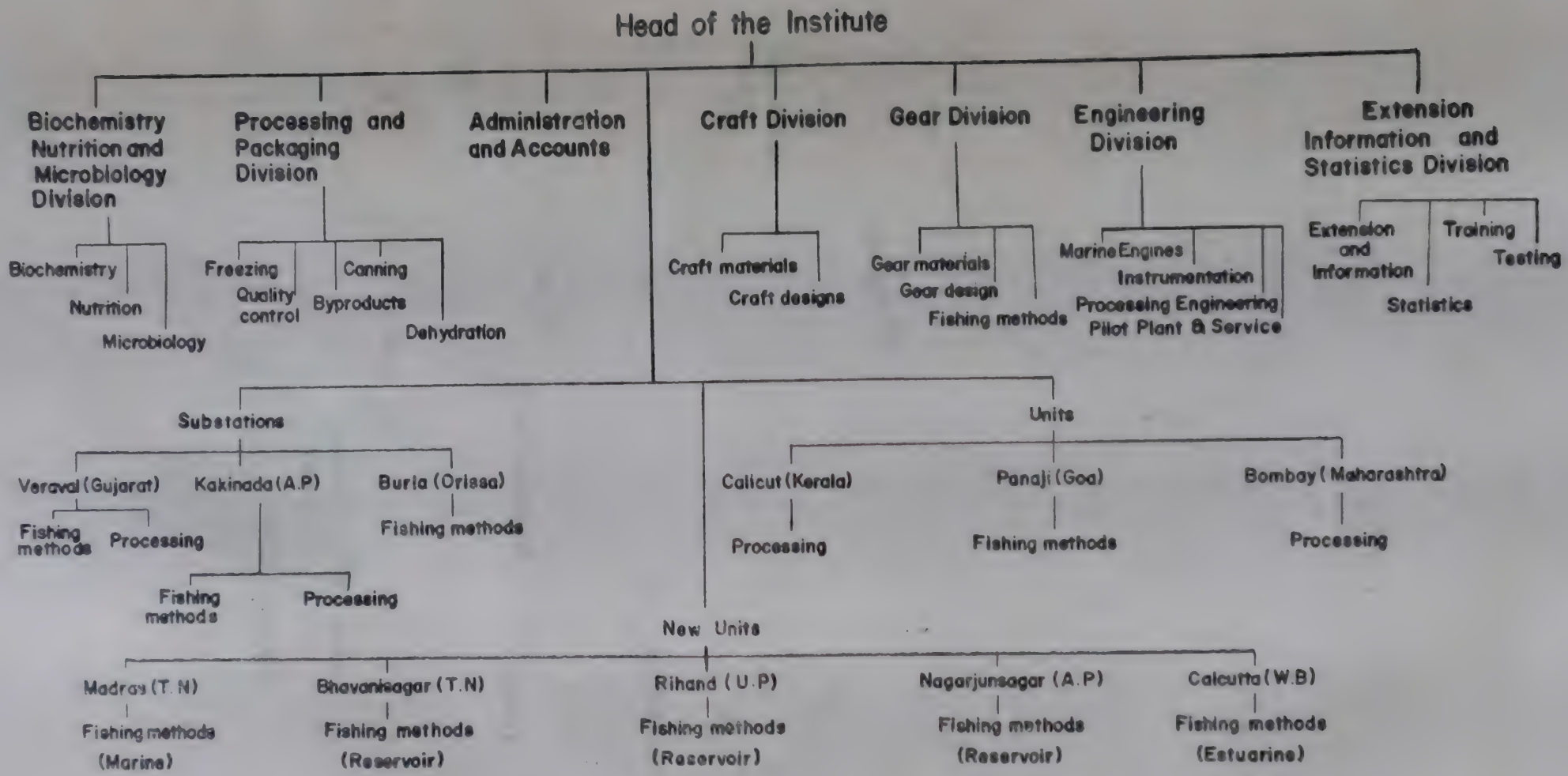
CLEAR VISION
HARD WORK
IRON WILL
STRICT DISCIPLINE

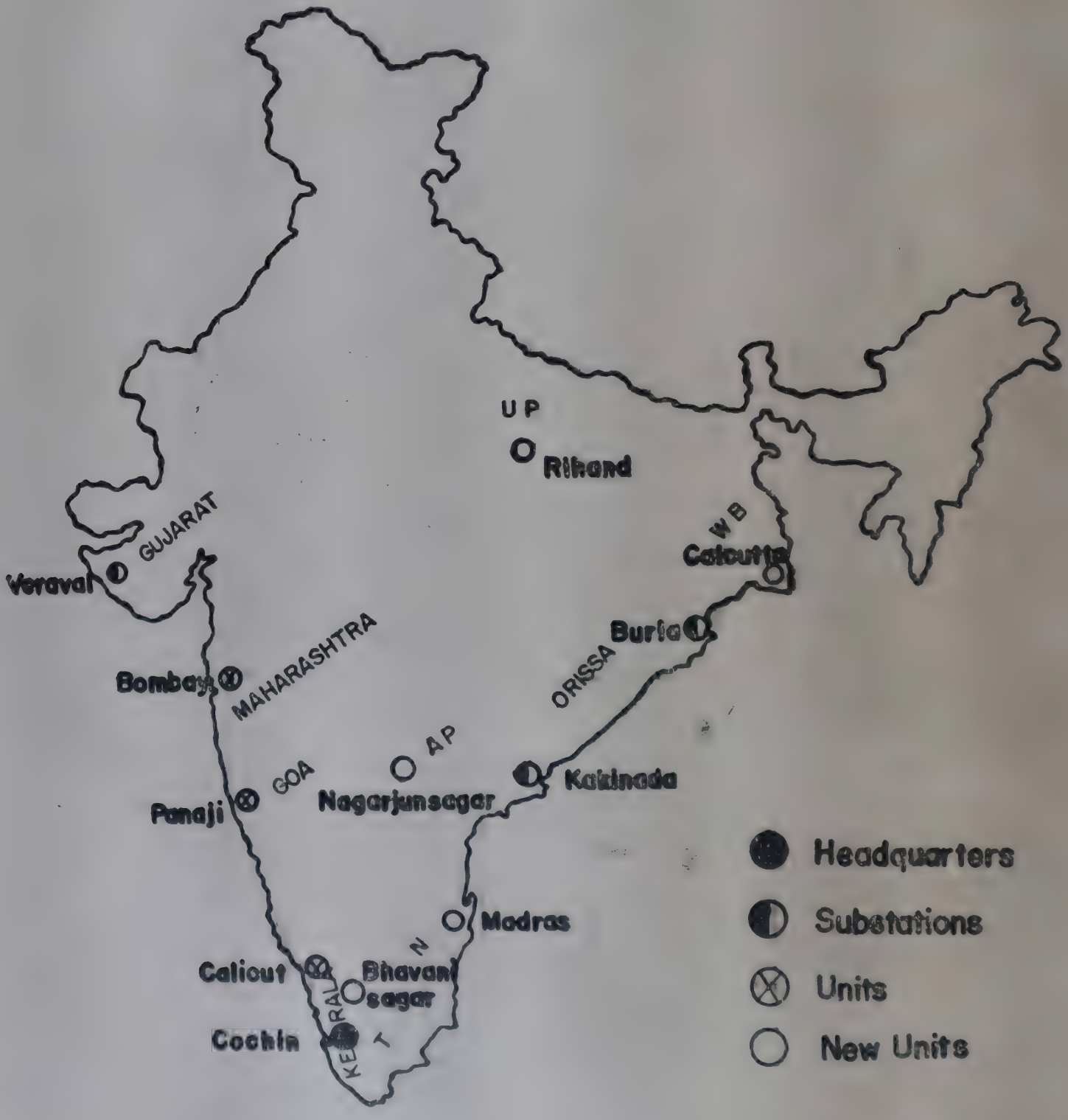
Indira Gandhi.

ORGANISATIONAL CHART

Central Institute of Fisheries Technology

Headquarters: Cochin

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Units
New Units

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
ITS CONTRIBUTION TO AND ITS FUTURE ROLE IN NATIONAL ECONOMY

A. N. BOSE

Fish is one of the most valuable natural resources available to a country and optimum use of this natural resource is in the national interest. Amongst the protein-rich foods, in which our country has a considerable shortage, fish provides a high quality protein at a comparatively cheaper price. Catching, handling and marketing of fish create job for hundreds of thousands of persons. Fish and fish products are also important items in international trade. Considering the potentialities of fishery not only as a major supplier of protein foods but also as a natural resource of high economic value, the maritime nations of the world have given special attention to its exploitation.

India with her vast coast line and nearness to the rich fishing grounds should naturally exploit this valuable natural resource. The shortage of protein and need to earn foreign currency to support industrial and economic development of the country add an element of compulsion in this effort. The optimum economic exploitation of fishery resources, however, depends on many factors, starting with location of the good fishing grounds, use of suitable fishing gear and craft, proper handling of fish on board the fishing vessels, at the wharfs, at storages and at the marketing places, provision and efficient operation of cold-storages, processing units etc. Scientific knowledge on conditions affecting these factors is growing rapidly, yet there are many things unknown or not properly understood. Hence the successful exploitation of fish resources must accompany scientific research in the basic principles as well as in their applications. The opening of the Central Fisheries Technological Research Station (later renamed as Central Institute of Fisheries Technology) in 1957 is a landmark in the scientific development of fisheries in this country and speak eloquently on the foresight and deep interest of the Indian Government in proper exploitation of this valuable resource.

Dr. A. N. Bose was the first Director of the Institute and later a member of its Achievement Audit Committee. Currently Dr. Bose is Vice Chancellor of Jadavpur University. – Eds.

In the establishment of Central Institute of Fisheries Technology, the multi-disciplinary character of the fishery in its conservation and exploitation, was kept in view. The Institute with two divisions called Wings - Craft and Gear wing and Processing Wing - with a number of Sections with different scientific identity was geared to tackle the fisheries technology in all its aspects and the results achieved at the Institute so far have amply demonstrated the necessity for such an approach.

Introduction and popularisation of mechanical fishing boats in India owe much to the investigations carried out at CIFT. Along with new gear designed by CIFT, these mechanized boats contributed much to the catch of prawn - the mainstay of our export trade In marine products. One of the most important contributions of CIFT towards the quick acceleration in the earnings of foreign currency through export of marine product is in the improvement and enforcement of quality-standards, which have ensured a good market for our fishery-products through continuous technical assistance and advice to the trade to make it quality-conscious in production. The basic scientific work done at CIFT has greatly enriched the fund of knowledge in fishery technology. CIFT did a creditable job in the past but the future presents many challenging problems.

More intensive exploitation without irreversible depletion of the resources requires amongst others, larger fishing boats which may stay out for fishing for more number of days at a time, are capable of covering wider areas and are equipped with the most suitable type of gear for the boat and for the fishing. CIFT has been mainly responsible for the creation of requisite know-how for the design and construction of the smaller mechanical fishing boats with wooden or steel hull. India has now the capability for building larger fishing boats but we still are dependent on foreign know-how for the design of such boats. CIFT should have the facilities and expertise created to cater to this need. More urgent attention is called for in the proper design of fishing gear. Maintenance and operation of large fishing boats are expensive and sufficient catches are necessary to meet the costs. Design of fishing gear is rather complex as it has to take into account biological aspects of fish-movement and behaviour, and its life-cycle but also hydrodynamic and physical and chemical aspects, including the consideration of the material for the construction of the gear. The approach has to be inter-disciplinary and has to draw upon the expert knowledge in different disciplines of science and engineering. CIFT has already the necessary base but would require senior scientists and engineers and facilities, like that of tank-testing to be able to effectively contribute in future development in craft and gear for optimum exploitation of the fishery resources available to the country.

Fish which is caught has to be kept in good condition for selling as wet fish or for longer preservation by any of the commercial methods. In India availability of marine fish for the people staying away from the coastal regions is restricted by the failure to transport, store and market fresh-fish in sound state. But unless marine fish is so available, the increased catch of fish will not help in improving the protein-food intake of our people. Hence

urgent attention is called for in developing suitable methods of transport and storage of such fish so that it is available at a price to suit the economic condition of the people. Design of containers for transport and transport vehicles both by rail and road should receive closer attention together with investigations on storage and marketing facilities.

Freezing, canning and dehydration of fish are required for international market to earn foreign currency. The phenomenal growth of the export earning through frozen and canned prawns in particular does credit to fish-processors and technologists of our country. But they cannot rest on their laurels and be complacent. International market is highly competitive and quality conscious. Food laws in the importing countries are becoming more and more strict on the aspects concerning public-health and public-interest. Rising standards of living and sophistication in daily life have made the consumers more selective and discerning on their purchases particularly of the food items. Hence continuation and growth in the export of material like frozen prawn depends on our capability to remain abreast of the developments in science and technology, improvements in the methods and machines so that products like frozen prawns are prepared with the best utilization of the raw material, consistent with high quality and reduced production cost. The quality of packaging requires particular attention, much more than what it has received till now. Besides its eye-appeal it has important role in preserving the quality of the packaged material.

Against the background of the present socio-economic condition in India and the present state of industrial development, the dehydrated fish should be one of the commodity through which fish caught in coastal regions can be made available to the people living in other parts of the country. Neither the present method of sun-drying nor the hot air drying in enclosed space, gives products of good quality at reasonable price. While process like accelerated freeze-drying technique will be too costly, there is need to find out a method which will give an acceptable product at a suitable price. CIFT should take up such a problem as a challenge and give priority to its solution.

While considering the utilization of marine fish, the problem of disposal of 'trash fish' which is caught with quality fish looms large. 'Trash fish' constitute bulk of the catch but gives little economic return at present. It will be undesirable for a country with chronic shortage of protein foods to allow high quality protein in such fish to be wasted. Conversion into fish meal for animal-feeding is convenient method of utilising the trash fish provided sufficient quantities are available regularly at the plants for economic operation. But through animal-feeding, the fish protein is converted into flesh of animals by a bio-chemical process of rather low efficiency. Direct consumption of fish protein in 'trash-fish' by human being will be desirable for best utilization of this valuable material. Many species of trashf ish are not consumed because of ignorance, superstition and traditional food-habits of consumers. There are also sometimes objectionable constituents which account for unacceptable taste. In some cases constituents which

may cause ill health may also be present. It is necessary to undertake intensive studies on 'trash fish' from the point of view of the nutritional quality, presence of any objectionable constituent and their removal, suitable processing methods to make 'trash fish' acceptable and methods of popularisation of 'trash fish' or protein preparation, made from it. Proper utilization of 'trash fish' will also improve the economy of fishing operation.

World fishery resources are though considerable, not inexhaustible. With increasing number of fishing boats with efficient fishing gear in operation, time will soon come for limiting catch. Hence whatever catch is made, it has to be utilized to the greatest advantage to the nation. This is particularly necessary in India with her large and still increasing population and limited areas for food cultivation. The institutions like Central Institute of Fisheries Technology have an inportant role to play in assuring that above mentioned objective is met. The Institute has had creditable past and future should be more glorious.

The fullest possible enjoyment is to be found by reducing your ego to zero.

— G. K. Chesterton.

The only way to keep your health is to eat what you don't want, drink what you don't like and do you'd rather not.

— Mark Twain.

Show me a man who doesn't know the meaning of the word 'fail' and I'll show you a man who ought to buy a dictionary.

— Albert Einstein.

There are three faithful servants - an old wife, an old dog and ready money.

— B. Franklin.

Adversity is the midwife of genious.

— Napoleon I.

Cynic is a man who knows the price of every thing and the value of nothing.

— Oscar Wilde.

It is most dangerous now-a-days for a husband to pay any attention to his wife in public. It always make people think that he beats her in private.

— Oscar Wilde.

You have gone through the origin and development of the Institute. Now see what are its contributions.

In its relatively short span of existance the CIFT has been able to make significant impact on the fishery industry of the country through its various research, development and education activities.

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

A GLIMPSE OF ITS ACHIEVEMENTS

The present day Indian fishery industry has no semblance to what it had been about two decades back. The marine fish production which stood at a mere 0.6 million tonnes per annum in 1955 rose to 1.23 million tonnes in 1973. From a modest Rs. 37 million in 1962 the realisation of export earnings from processed fishery products shot up to Rs. 800 million in 1973. There has been a steady increase in the variety of processed products exported taking into account the diversity in requirements in the export markets. There is today greater awareness on the quality of fish both among the producers and consumers. There is a perceptible improvement in the quality of traditionally processed fishery products now available for sale in the domestic markets. Fishery industry is no more 'fishy' and enjoys today a status equal to or better than that of many other major industries. This industry functions as the backbone to the nation by providing it with high class protein for feeding its populace and contributing a major share to its foreign exchange earnings. The significant role played by the Central Institute of Fisheries Technology in bringing about this revolution cannot go without due acknowledgement. The status and standard of the industry today are among what the Institute had been trying to bring about through its various research, development and extension programmes all these years. A glimpse through some of its significant achievements may help one to assess its impact on the industry and the nation as a whole.

Fishing boats form the single largest segment of investment in the fishing industry today and their normal working life is very much dependent on the choice of material with which they are made up of and with how much of care they are maintained under service thereafter. As a result of continuous research, the Institute has been able to guide the production specialists both in private and public sectors in the right choice of construction materials as well as a comprehensive programme of maintenance required for their durability and trouble free service.

Wood is a well known building material for fishing crafts and it continues to be in great demand for the construction of the modern mechanised fishing boats as well. Realising the importance of wood as a craft material, comprehensive studies were undertaken on the technological characteristics of a large number of species of Indian timbers suitable for boat building. Of the 32 species of Indian hard woods studied so far teak, *(Tectona grandis)* sal. *(Shorea robusta)* gurjan, *(Dipterocarpus indicus)* bijasal,

(Pterocarpus marsupium) padauk, *(Pterocarpus dalbergioides)* sissoo *(Dalbergia sissoo)* and the like have been graded as the primary timbers suitable for all heavy duty purposes in bigger class of boats. The secondary species are the aini, *(Artocarpus hirsuta)* venteak, (*Lagerstroemia Panceolata)* kindal, *(Terminalia paniculata*) hopea *(Hopea parviflora)* and laurel *(Terminalia tomen osa)* which can find extensive usage in the smaller class of fishing boats. In lieu of the conventional teak wood, the Institute introduced the extensive use of aini wood for most of their prototype boats built during the sixtees. When teak and aini became scarce and their prices shot up, profitable use of venteak in fishing boat construction was brought to light. Three of the prototypes built at C I F T proved beyond doubt, the versatality of venteak as a boat building material and its usage brought down the over-all cost of the hull considerably. With the initiation of studies on wood seasoning and wood preservation, it was further possible to bring into usage mango *(Mangifera indica)* wood and haldu *(Adina cordifolia)* wood after prior seasoning and preservative treatment.

Wood being an organic matter easily deteriorates more especially in sea water due to the infection caused by a number of marine organisms like marine bacteria, marine fungi. marine wood boring organisms and marine foulants. As a result of well planned research carried out with these organisms under a new bio-assay technique and toxicological studies, a number of preventive measures have been worked out which are now finding extensive usage

Imported copper sheets were being used over the wooden hull below waterline for the prevention of marine wood borers attacking timber structures. It was possible for this Institute to locate a cheap and more suitable indigenous aluminium-magnesium alloy and prove its suitability as an efficient sheathing material as good as copper. This has helped to conserve a considerable amount of the much needed foreign exchange.

Toxic wood preservatives like coal tar and its various derivatives (creosote and its constituents), pentachlorophenol, copper-chrome-arsenic compound, organo metallic compounds and the like have been shown to successfully prevent the wood decaying by organisms. A number of indigenous natural resins are also employed in the preparation of surface coating compositions to improve the service life of wooden structures under constant and intermittant exposure to rain, shine and sea water. Indian dammer resins, cashewnut shell liquid (CNSL) resins and fish oils fortified with toxic chemicals have been successfully offered as suitable indigenous substitutes for the imported 'Dammar Batu' especially for the benefit of the fishermen of Gujarat and Maharashtra States. The effect of irradiation on boat building timbers with a view to increasing their resistance to decay has been studied in collaboration with Bhabha Atomic Research Centre.

Fishing boats gather an abundant quantity of marine growths on their under water portions which cause considerable frictional resistance to the boat resulting in speed loss and increased fuel consumption. Investigations so far carried out at this Institute have emphasised the need for a well designed toxic coating of paint on the under-water hull surfaces so as to ward off these marine settlements for a prolonged period. The drawbacks

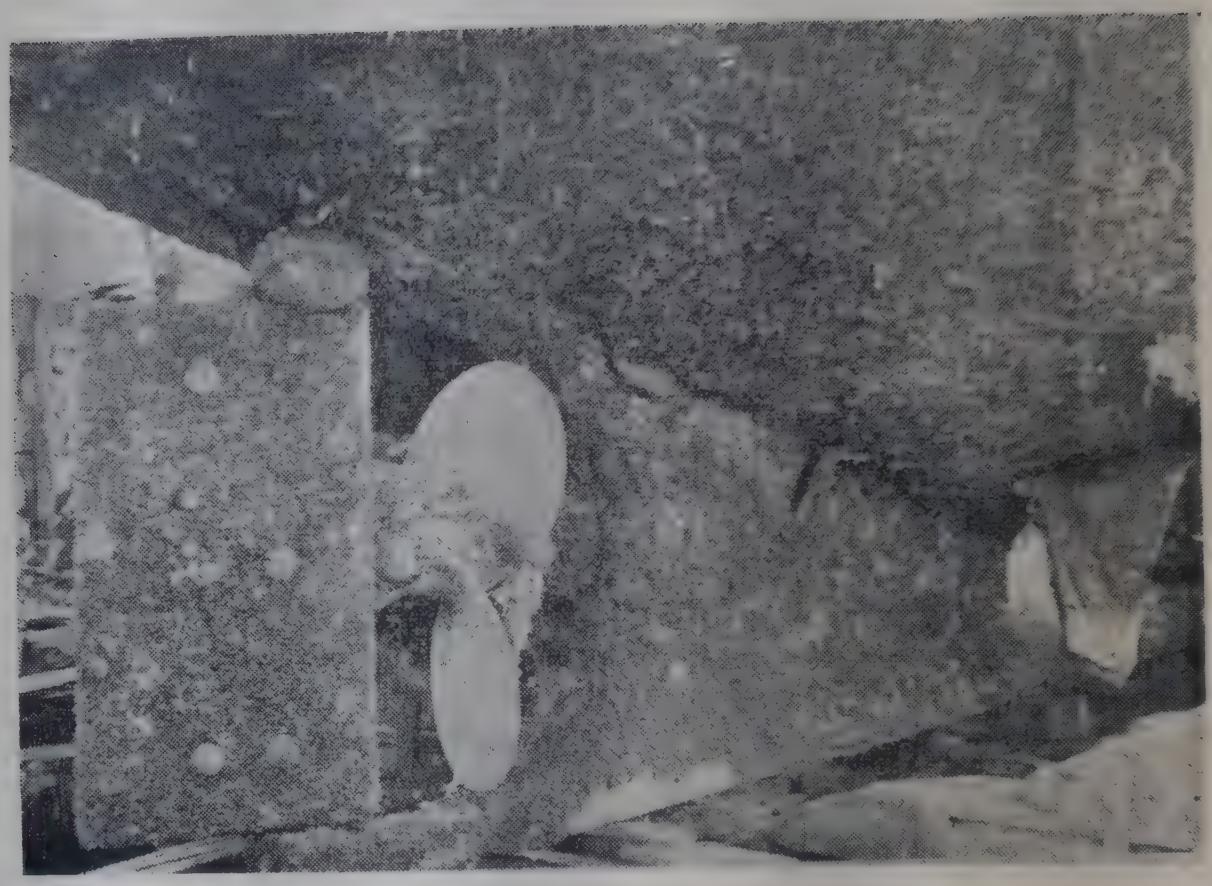
encountered with the commercial anti-fouling paints and the need for a new concept of more toxic paint have been lime lighted. CIFT after studies on this problem over years, has come out with new compositions based on cuprous oxide, copper-aceto-arsenite and tributyl tin oxide, each of them possessing enhanced resistance to marine fouling.

According to the finding of this Institute the Indian made fibreglass chopped strand mat in combination with activated polyester resins will result in a toughest new material - Fibreglass Reinforced Plastic (F.R.P.)-that can be used as a sheathing material for our mechanised wooden trawlers and also as a lining for the fish holds inside the boat. A number of other uses have also been brought to light for the benefit of the fishing industry. Today fishing boats can also be fabricated out of F. R P. with many advantages over the conventional steel and wood. In fact mass and quick production of the standard sizes of trawlers are possible with F.R.P. to achieve the rapid expansion of our fishing fleet. Investigations have indicated the possibilities of using F.R.P. for the fabrication of 'Malabar Canoes' (West coast) and 'Catamarans' (East coast) which form nearly 90% of our indigenous fishing crafts.

In the construction of modern wooden fishing boats a large number of metal fastenings are involved in the innumerable joinery works. Generally bolts, nuts, screws, nails, spikes and tacks for the boats are made out of copper and brass involving very high expenditure. The conventional black iron fastening do not go well with certain timbers and have a short life in seawater. Studies have revealed longer life and efficient fuctioning of galvanized iron fastenings and aluminized fastenings (both by hot-dip method) and their compatibility when in contact with wet wood. G. I. fastenings have been extensively used in all the Institute's prototype fishing boats with excellent results.

Sea water as well as marine atmosphere are highly corrosive in nature and metals exposed to them dateriorate rapidly. Steel trawlers suffer rapid wearing on their hull plates unless they are adequately protected with anticorrosive coatings both above and below water line. The comparative efficiencies of 'red oxide', 'zinc chromate', heavy duty coal tar epoxies and CNSL based coatings have been evaluated both under laboratory and field conditions. Corrosion due to bi-metallic contacts in sea water has been located and suitable remedial measures by way of standard anode installations have been tested and recommended. Only by suitable ship bottom painting system coupled with adequate cathodic protective system, the normal working life of a steel trawler under tropical Indian conditions can be enhanced. The newly introduced indigenous aluminium-magnesium alloy in sea water requires a special system of protective coatings. This has been successfully worked out and recommended for exploitation.

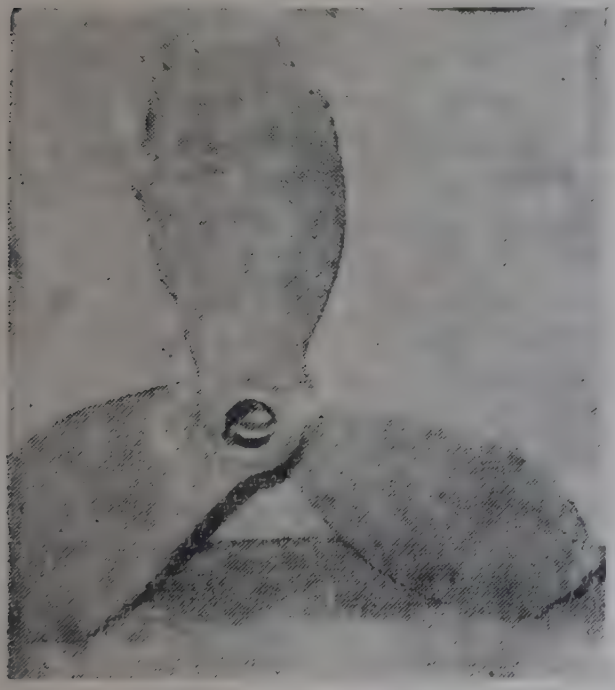
This Institute has also designed and developed a ship-bottom anticorrosive paint incorporating CNSL resin available in abundance indigenously. A suitable single pack metal primer for aluminium surfaces has also been brought out. Marine quality aluminium screws and tacks have been developed and proved that they go well with aluminium under -water sheathing.



Marine fouling complex on the boat hull

Ferrocement Boat - 'INDCRETE'

Conventional manganese bronze-propellers undergo corrosion due to de-zincification as has been revealed by a number of case history studies made by this Institute. Proper alloying and incorporating inhibitors like arsenic and antimony have been found to solve this problem. Spheroidal graphite cast iron with nickel (21 to 24%) is a new material that has been tested and found suitable for marine propellers as an alternative to the high tensile brass. Ternary alloys of aluminium were recommended to serve as efficient anodes in lieu of electrolytic zinc anodes. Ordinary grey cast iron fittings have shown better performance besides being very cheap compared to the conventional mild steel fittings in smaller class of fishing boats.



Marine Corrosion – Propeller

The Institute has designed a number of mechanised fishing boats and has actually built seven prototypes each with newer innovations. When the overall construction cost of fishing boats were rapidly soaring high, a cheaper version of a prototype was constructed as a perfect proof of its reality. A number of repeat performances were made when two numbers of fifty feet trawlers were made for departmental use. The combination worked out resulted in the use of well seasoned venteak, as well as treated wood, hot-dip galvanized fastenings, aluminium alloy for the hull sheathing, cast iron for under-water fittings followed by protective painting schedule developed by the Institute. A clear saving of 30% in cost over the conventional hulls was made possible by these innovations.

'Ferrocement' boat construction (steel reinforcement with cement mortar filling and coating) has opened new avenues in India. CIFT has worked out the basic guidelines for the construction of fishing boats out of this new material. Boats between 40 and 80 feet OAL (12m. - 25m.) when built out of steel and cement will be lighter, cheaper and long lasting than wooden or steel vessels with minimum maintenance cost.

Similarly investigations have shown the possibilities of using F. R. P. and treated wood like mango and haldu for the entire construction of fishing boats.

F R P fishing boat built in India

In the introduction of mechanisation for modernising the Indian fishing industry the major hurdle was nonavailability of suitable designs of fishing boats to suit local conditions. One of the urgent tasks of the Institute was therefore to develop suitable designs of boats for indigenous construction. Twelve standard designs of boats were developed ranging from 7.6m. to 15.2m. for multipurpose fishing. One 11.6m. boat for pole and line fishing, one 18.42m. trawler-cum-fish carrier and another 17.5 m. trawler-cum-purse seiner have been developed.

These designs were supplied to various State Fisheries Departments, private boat yards and entrepreneurs in this line and it is to the credit of the Institute that a majority of the 10,000 and odd boats operating along the different parts of the Indian coasts at present have been built according to these designs.

The indigenous fishing gear of India, however unsophisticated they might appear to be, are evolved by the rule of thumb, long tradition and trial and error methods and have obviously stood the test of time. Study of the traditional gear will not only provide basic information on the status of the industry, but will also serve as a guide for future development. Since there was no comprehensive information available on this subject, a survey of fishing gear in vogue was conducted covering the coasts of Gujarat, Kerala, Mysore, Tamil Nadu, Andhra Pradesh and Orissa and Inland water spreads. The survey helped to identify the areas of development such as the need for improvement in the material used, their preservation besides introduction of modern fishing gear and methods for intensive and extensive exploitation of the known fishery resources.

Although different types of vegetable fibre twines were being used traditionally in the country for fabrication of fishing gear, no information was available on the technical characteristics of these twines. Extensive studies carried out on the basic and dynamic characteristics of various textile materials such as cotton, hemp, nylon, sisal, manila, coir etc. enabled evolution of specifications for different types of twines required for the various fishing gear. The Institute's specifications for cotton twines have subseqently been adopted as a national standard.

In the Gujarat and Maharashtra coasts, considerable quantity of imported Italian hemp twines were in use for fabrication of gill nets for capture of dara *(Polydactylus indicus)*. A diligent search among the Indian hemps enabled the Institute to recommend a particular variety, namely 'Green shorts', available in Karwar (Karnataka State) area as a good substitute for imported Italian hemp and thereby effecting a considerable saving in foreign exchange.

Unles suitably treated the life of the fishing gear, particularly those made of vegetable fibre twines, will be very short. The Institute has deviced specific methods of treatment for various materials used in different classes of fishing gear, which include among others the more popular tanning, tannin 'fixation' and subsequent coal tar treatment on tannin fixed twines.

Synthetic twines in fishing gear manufacture is of relatively recent introduction. The Institute took up the work of laying down suitable specifications of these twines so that a standardisation in quality of the twines are brought about. The specifications so

evolved for nylon, polyethylene twisted monofilaments and high density polyethylene (HDPE) tape twines both flat and fibrillated, have formed the basis of the material standard later issued by ISI.

Floats constitute a vital component of fishing gear. Though floats of different kinds were in use by the fishing industry in the country, no information was available on their basic properties, relative efficiency and suitability for different kinds of fishing gear. On the basis of comparative studies carried out on indigenous as well as imported floats specifications were drawn up which enabled the Indian industry to come out with suitable floats for different fishing gear including those required for deep sea trawling.

Constant check and test have also contributed towards continuous improvement of the quality of the different materials used in fishing.

With the advent of mechanised fishing and introduction of trawling, the Institute made notable contribution by developing suitable trawl nets for boats ranging from 7.6 m. (25′) to 30.5 m. (100′) as shown below.

Investigations to improve the efficiency resulted in the introduction of new rigging pattern, addition of false head ropes, gussets, kites and tickler

Length of the boat (m.)	Approximate Horse Power of the engine	Approximate size of the net (Head rope length between wing ends)		Approximate specifications of the Otter board	
		Four seam type (m.)	Two seam type (m.)	Length X Breadth (m.)	Weight (Kg.)
7.62	10 - 14	7.32 8.40	12.00	762 x 381	10 - 15
7.62	15 - 20	10.05 10.65 13.40	9.75 11.43	889 x 445	18 - 20
9.15	30 - 35	13.70 14.30	12.95	1016 x 508 1067 x 610	30 - 35 32 - 36
9.45	36 - 40	16.75	13.70 21.34	1443 x 635	42 - 45
10.97	50 - 60	17.35 21.34	18.29	1397 x 635	50 - 55
12.10	80 - 90	16.75	22.86	1397 x 635	60 - 70
15.24	100 - 120	25.90	22.86	1524 x 762	80 - 90
17.50	210 - 240	35.00	—	2000 x1000	250 - 270
22.00 to 23.35	400 - 600	50.00	—	3000 x 1200	300 - 340

chains. Improvements were also made in otter boards covering flat, rectangular curved, oval, V-form and L-shaped for bottom trawling and vertical curved for midwater and pelagic trawls.

Improved versions of trawls such as long wing and six seam trawl have been developed. The recent innovation of 'bulged-belly' type trawl – a new concept — marks another major contribution of the Institute in increasing the prawn catch per unit effort. This type of trawl net can increase the catch of shrimp by more than 30% compared to the conventional type, while requiring much less quantity of twine for its fabrication.

Net techniques such as operation of 'double-rig' trawl from medium and large boats, and twin trawling to increase shrimp catch have also been successfully developed and tested.

Gill nets, a common traditional gear used both in inland and marine fisheries, though used extensively was not rationally designed. Lobsters are good export earners and there is steady demand for this item. Ever rising demand for lobsters for processing and export necessitated development of effective means for exploitation of lobster resources of this country. The Institute made an all out effort to design suitable non-injurious gear for their exploitation along the south-west coast of India, known to be one of the richest grounds for lobsters. The design of gill net developed was successfully introduced in this area.

Fishermen of Gujarat region were using non-uniform mesh and twine sizes for gill nets. As a result of studies carried out by the Institute's Sub-station at Veraval, the mesh and twine sizes were rationalised and standard nets have been developed for hilsa and pomfret. Similarly, suitable design of gill net was also evolved for capture of seer on the west and east coasts.

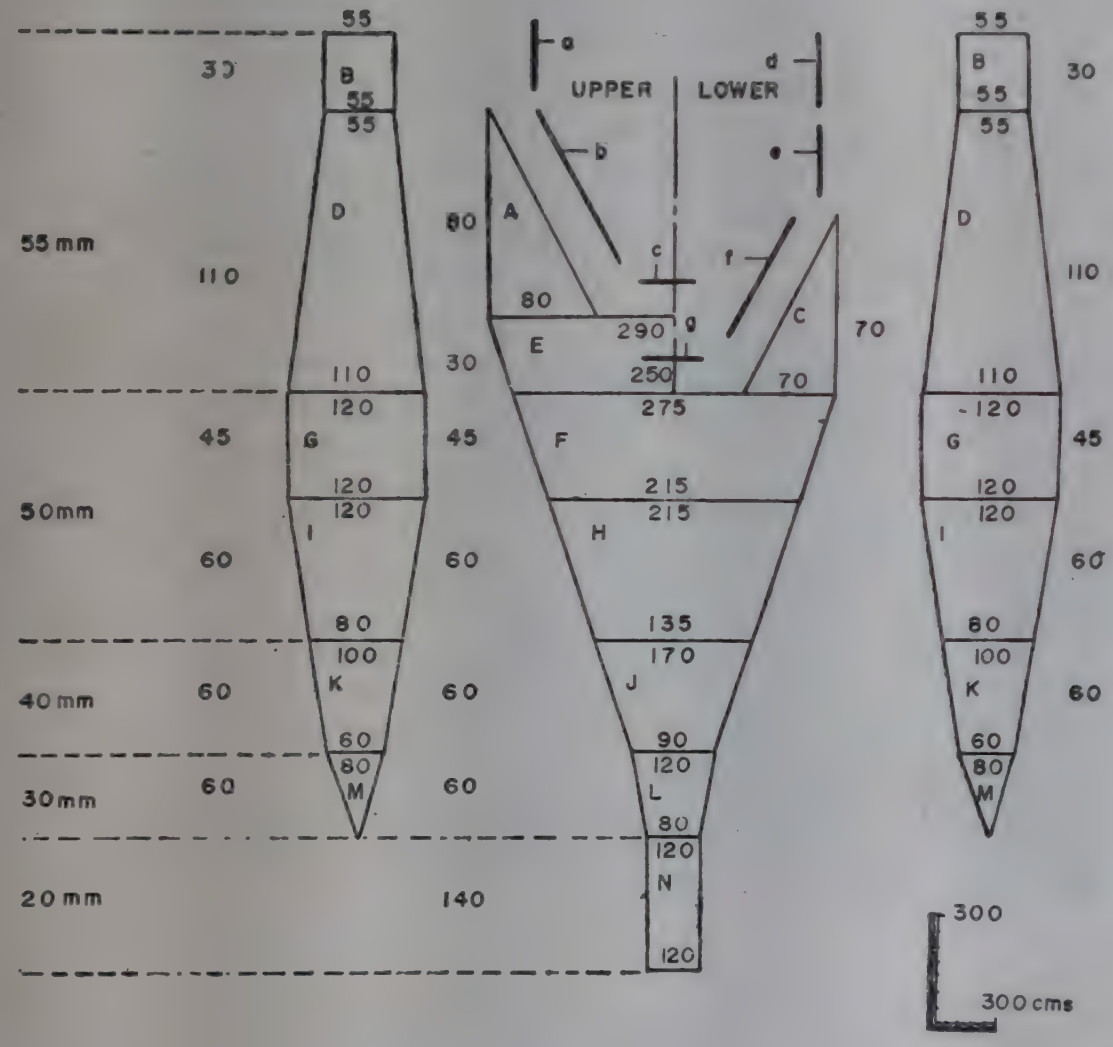
Studies on spatial distribution of fish (both inland and marine) have helped in reducing the height of net resulting in a substantial reduction in the cost of the net.

In order to extend the benefits of modern fishing techniques to inland water areas auch as reservoirs, lakes and the like, work on inland gear technology carried out from the Institute's Sub-station at Hirakud (Orissa) and Unit at Nangal (Punjab) resulted in the development of efficient gear for exploiting the resources of these inland water spreads. It has been shown that while in shallow reservoirs gill nets having greater entangling capacity like framed net and trammel nets were more effective, in deep reservoirs simple gill nets were more effecient. Further, selectivity studies on coloured gill nets, framed nets and trammel nets enabled evolution of standard gear for capture of catla, rohu and mrigal.

Realising the need to diversify fishing in order to make operation of small fishing boats economical, trolling, a cheap method of fishing. was developed for exploitation of predatory fishes such as seer, tunny and barracuda. Of the different artificial lures or jigs tried, buffalo horn and fish head jigs, made with indigenous materials, were found to be the most effective ones, particularly for seer. Since the fish caught in troll lines are likely to escape by struggling, a method was also developed to stun the hooked fish by the application of electrical impulses.

15M. BULGED BELLY TRAWL(FOUR SEAM)

(Suitable for 10·97M. trawler)



WEBBING

Twine Size: A to E 20/7/3
F to I 20/8/3
J to M 20/9/3
and N 20/10/3

MESH SIZE

A to E 55mm. F to I 50mm.
J and K 40min. L, M 30mm.
N 20mm

ROPES

Head Rope: 12min. dia.
Foot Rope: 19mm. dia.

OTTER BOARD

Horizontal Curved
1200x600w.
Weight: 60 kgs.

FLOATS

7 Nos. Aluminium.
Spherical Shape
127mm. dia.

SINKERS

60 Nos. Lead
Spindle Shape
19mm. Bore dia.

HEAD LINE:- 15 M.
GROUND ROPE:-17·60M

Fig: 1

Shark long-lines and hand lines for kalava were designed and operated successfully using completely indigenous material. Sardine and mackerel, shoaling pelagic fishes, constitute the main source to boost up the country's fish production. Designs of a single boat purse seine for operation from small vessels (at present used only for trawling) were developed and successfully demonstrated.

In addition to the regular programme, the Institute carried out a number of short-term investigations at the request of different maritime and inland States. Accordingly, a survey of the resources and fishing gear of the Brahmaputra river system was carried out and recommendations made to improve the existing fishing gear and methods for better exploitation of the available fishery. Exploratory fishing was carried out in Sunderbans in collaboration with the Central Inland Fisheries Research Institute (CIFRI) and the Department of Fisheries, West Bengal and suitable gear for exploitation of the area recommended. Likewise, surveys were conducted in Mathura (U.P), Kalyani and Kulia bheels (W.Bengal) and suggestions made to State Governments regarding extension of fishing areas with suitable gear.

Investigations carried out in Gobindsagar (MP) reservoir enabled this Institute to evolve suitable design of gill net for effective exploitation of *Labeo calbsu* an endemic population of the reservoir.

Preliminary surveys conducted in Malampuzha reservoir (Kerala) and Ukai dam (Gujarat) have indicated potentials for increasing the catch and detailed schemes drawn up and furnished to the respective States.

In spite of the rapid increase in the number of mechanised boats, the major portion of the total landing is still contributed by the traditional craft. Therefore improvement to these craft and gear form an integral part of the programmes of this Institute.

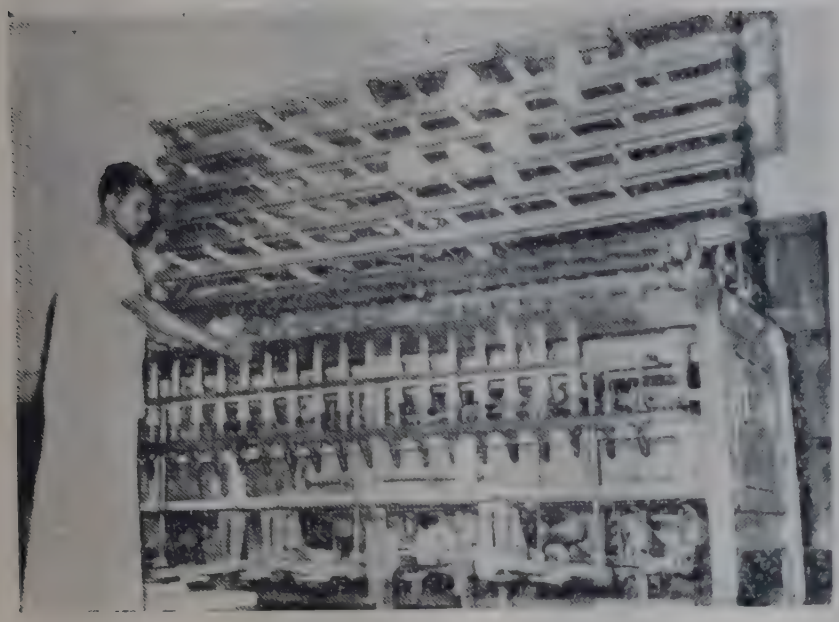
An inboard-outboard diesel engine for mechanising small country crafts to replace imported and expensive outboard motors such as those used in Gujarat has been developed and successfully tested.

With a view to improve the catch potential of indigenous crafts, a Kerala dugout canoe was motorised using an outboard motor with a large reduction gear and heavy duty propeller. The boat was successfully used for trawling and trials indicated that the operation could be economical. Design of a suitable trawl net was also evolved for operation from this type of canoes.

Studies carried out on stake nets with a view to conserving the prawn resources indicated that the present mesh sizes are too small which trap even the juvenile ones and recommendations made to increase the mesh size.

In the wake of mechanisation, selection of engines and propellers with particular reference to size of the boat and type of fishing it was engaged in, was a serious problem. This Institute developed a number of specifications of engines and propellers for different sizes of boats.

With the introduction of indigenous engines it became necessary to carry out thorough tests to assess the performance of the engine and its suitability for use in fishing boats. Almost all the indigenous engines manufactured in this



Twine twisting machine

Hydraulic Trawl winch

Weed harvester–working model

country and offered for use in fishing boats have been tested by the Institute and recommendations made to improve the performance of these engines. These recommendations were incorporated by the manufacturers in the subsequent productions.

Continuous vigilance is maintained on the performance of indigenous engines and any defect noticed is immediately brought to the notice of the manufacturers for rectification. This has greatly helped to improve and maintain the quality of the engines

When air cooled engines were introduced in this country provision of suitable cooling and ventilation arrangements was a serious problem These problems were thoroughly studied and suitable ducting arrangements were suggested which have been adopted by the industry.

A standard was prepared to provide guide lines for selection of engines for fishing boats which is being issued as a national standard by the Indian Standards Institution.

Engine installation drawings have been made for various makes of engines which helped proper installation of engines.

Lignum vitae, an imported wood, has been used for making stern bearings, hitherto. Investigations carried out at the Institute indicated that certain Indian timbers such as Andaman bullet wood (*Mimusops littoralis*) and red cutch (*Acacia chundra*) could also be used as stern bearings and suitable recommendations were made accordingly.

With the increasing tempo of mechanisation, it was necessary to develop mechanical fishing accessories such as trawl winches which were being imported, for indigenous production. Investigations in the Institute resulted in the evolution of six different sizes of trawl winches and combination winches to cover boats ranging from 9 to 30 m. overall length.

Hydraulic winches which have many advantages over mechanical winches have been developed for the first time in India with the assistance of this Institute and the same have successfully undergone field trials in the Institute's test trawler 'Fishtech No. VI'.

Improved type of mechanical power isolation clutches have been developed for engines up to 300 HP which are being released for commercial production by the National Research and Development Corporation of India (NRDC).

Design of mechanical spraying arrangement for chumming fish in pole and line fishing has been developed at the request of the Laccadive Administration.

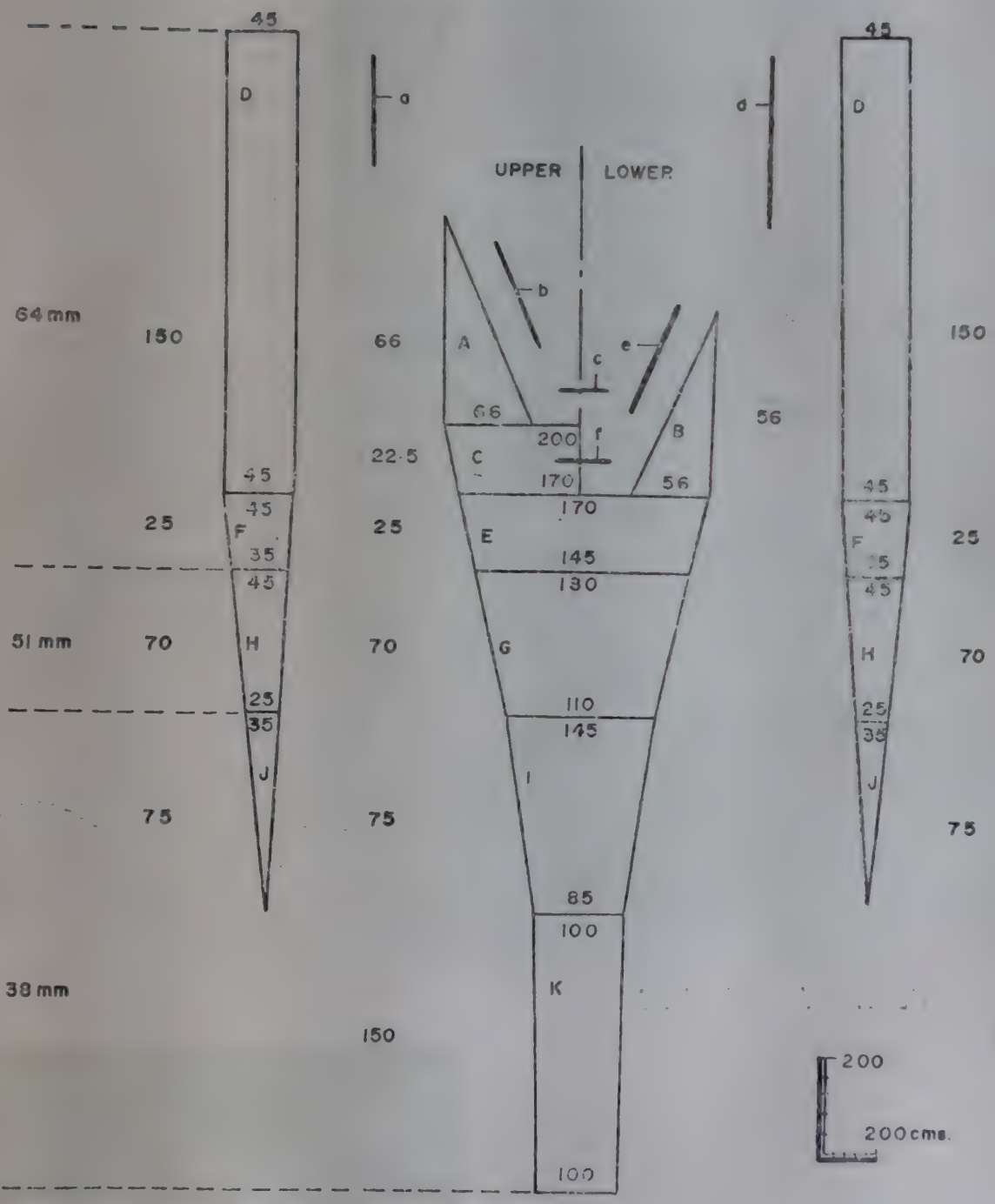
Design of gurdy for gill netting and line-hauler for long lining have also been developed with a view to diversification of fishing effort.

Studies carried out with a view to reducing the capital cost of the boat has resulted in the development of cheaper stern gear consisting of aluminium alloy stern tube and rubber lined mild steel tail-shaft in place of imported bronze or stainless steel shaft.

Thousands of hectares of inland water spreads like bheels, ponds, lakes etc. are lying derilict throughout the country due to infestation by aquatic weeds. Work carried out at the Institute has resulted in the development of

15·25M. FOUR SEAM TRAWL

(Suitable for 9·45M. trawler)



WEBBING

Twine Size: A to D 20/8/3
E to J 20/9/3
K 20/10/3

MESH SIZE

A to F 64 mm. G,H 51mm
I to K 38 mm.

ROPES

Head Rope: 12 mm. dia.
Foot Rope: 18 mm. dia.

OTTER BOARD

Rectangular Flat
1067 x 610 mm.

FLOATS

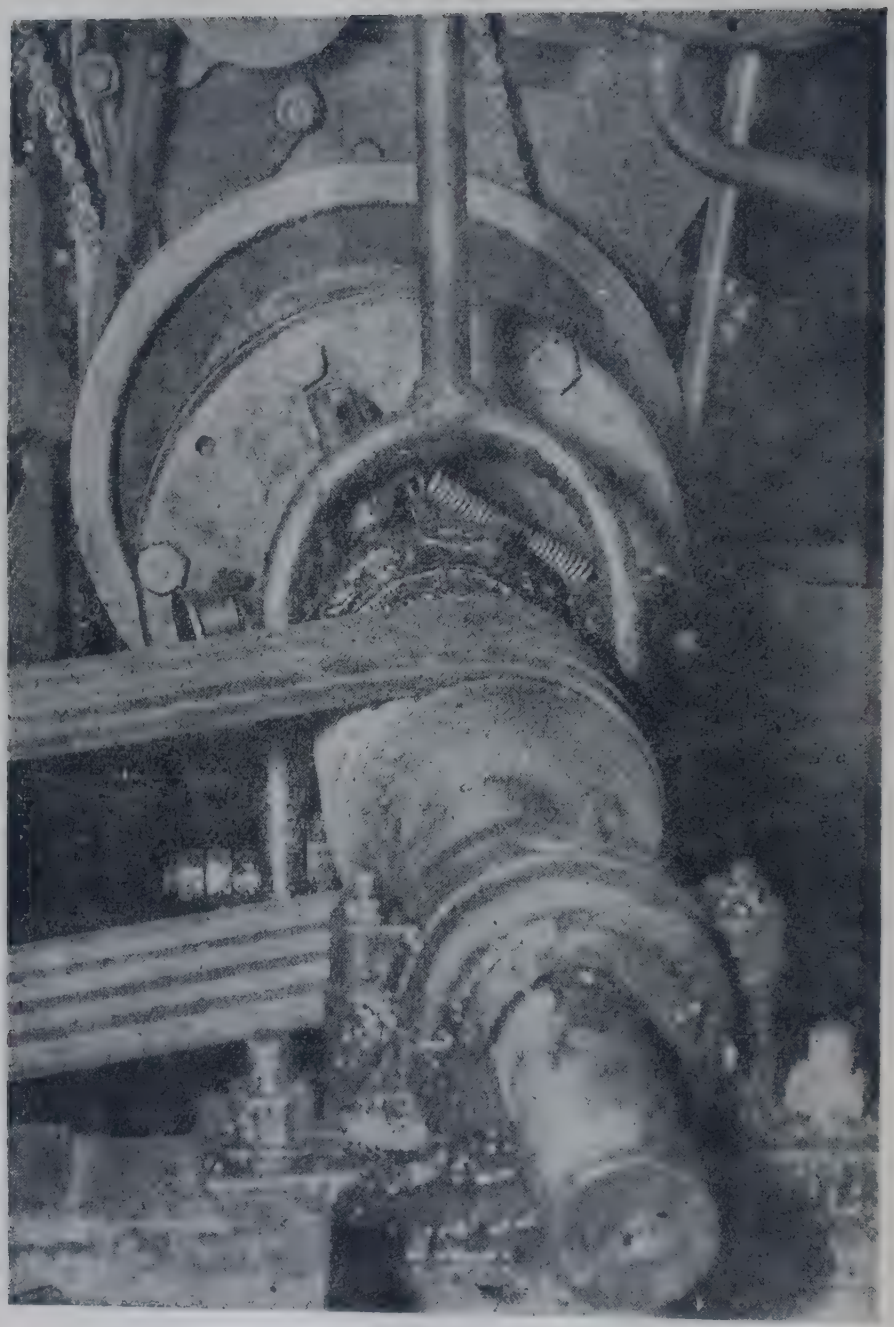
9 Nos. Aluminium
Spherical Shape
125 mm. dia.

SINKERS

55 Nos. Lead
Spindle Shape
0·22 kg. each.

HEAD LINE:- 15·25M.
GROUND ROPE:- 17·37M.

Fig. 2



Power take off Clutch

two different types of weed harvesters (both for floating and submerged weeds).

In a series of recent communications, while describing the development of cultured -pearl technology in India, it has been pointed out that a pearl culture industry can easily be developed in the country purely from indigenous efforts. For this, an indigenous method of producing shell-bead nuclei at an economic level becomes necessary so that the industry becomes self-reliant. A process for the production of spherical beads from the shells of Indian conch, *Xancus pyrum*, has been developed by this Institute. These beads are used as nuclei for cultured pearls. The equipment designed for the production of these beads consists of a grinding attachment fitted to an ordinary bench drill. The finished beads compare favourably with those used in the pearl culture trade in Japan.

Spherical shell beads as nuclei for cultured-pearls

Use of electricity for capture of fishes is gaining importance and this Institute has carried out pioneering work in this field.

Extensive studies have been carried out on the reaction of different inland and marine fishes to electrical stimuli resulting in the development of an electric shrimp trawl which improves the catch by 30%. Under-water lamps and an impulse generator have also been developed and prototype fabricated, and tested successfully under field conditions.

An electrical method was also developed for eradication of predatory fishes from nursery ponds before stocking.

The optimum utilization of landed fish is as important as its optimum production. This demands gearing up of research and development activities to put the fish to fullest use either by fresh consumption or by preparing suitable type of processed products and probable byproducts out of them. The technological know-how available to the fish processing industry in its infancy was limited and far from adequate to meet such requirements. As a result of the mechanisation of fishing boats and modernisation of its gear and other accessories the catch of fish was increasing manifold and ways and means had to be developed for its economic utilization. Research activities undertaken on these aspects have yielded fruitful results. It should also be noted, thanks to the development of indigenous know-how in all aspects of fish processing technology worked out by the Institute there have been a spurt in the number of processing establishments which could bank upon the services rendered by the Institute.

The modern fish processing industry in India from the very beginning has been dependent almost exclusively on one commodity *viz.* prawns. Frozen and canned prawns contribute the major share to the export of fishery products. Frozen prawns are known to suffer from a weight loss during thawing due to the loss of drip water. In order to make up for this loss at the consumer's end the processor adds extra weight of prawns in each carton. Considering the volume of trade in frozen prawn the loss of material sustained by the industry and the consequent loss of foreign exchange to the nation are of very high magnitude. The Institute took up this problem with priority and could come out with a successful method of treatment of peeled and deveined prawns with a solution of a mixture of sodium tripolyphosphate and potassium di hydrogen phosphate in definite proportions by which the drip loss could be completely prevented thereby increasing the yield by 10%. This treatment is equally effective in preventing the drip loss in frozen frog legs too. A similar problem met with peeled, deveined and cooked frozen prawns is excessive cooking loss to the extent of 45%. This could be brought down to 10 - 15% by pretreatment of the meat with the above phosphate solution containing common salt.

Development of black spots met with in whole and headless prawns during ice storage and the same met with in the former during frozen storage are objectionable. A simple method of dip treatment or glaze with sodium meta bisulfite solution could prevent this. In the case of whole prawns a dip for 2

minutes in 0.2% solution has been found to be highly successful. A method worked out to prevent the phenomenon of belly -bursting during freezing and frozen storage of oil sardines consists in pre-treatment of the fish with a 15% solution of sodium chloride for 15 minutes.

Though prawn has been the mainstay in our fish processing industry we have to explore the possibilities of processing other types of fish which our waters abound for the export markets. With this in view and taking into consideration the probable future requirements of the industry the Institute has worked out standard methods for freezing different types of fish and shell fish. In addition to the methods of freezing of prawns in different forms like headless, peeled and deveined, cooked etc. the methods of freezing of other shell fish like clams, mussels, crab meat and fish like sardine, mackerel, lactarius, tilapia, milkfish etc. have been worked out. Methods have also been worked out for freezing of seer and tuna in different forms like whole, chunks and fillets, individually quick frozen prawns, sardine and mackerel as also frog legs.

Temperature of storage is a very important factor in maintenance of the quality of the product. It was ascertained from the studies conducted at the Institute that in the case of frozen storage of prawns even a short term storage at a higher temperature like 10°F badly impaired the quality. This brings to focus the importance of maintaining the storage temperature low and without fluctuations which the industry has been advised to take care of.

Canning occupies a position next in importance to freezing. This too had been greatly dependent on prawns though there is, of late, a shift in its outlook and in a small way has started to embrace other fish in its fold. One of the problems faced by the prawn canning industry in the beginning was the irregularity in the drained weight which resulted either in overweight causing the processor to lose money for the excess material in the can or in underweight resulting in poor quality and consequent rejection of the product at the buyers' end. The Institute studied the problem and worked out a simple process in which by standardising the blanching conditions this phenomenon could be completely overcome. This has been done with respect to different size grades of prawns.

Certain species of prawns after canning and storage undergo a phenomenon called sloughening. Species belonging to *Metapenaeus affinis*, *Parapenaeopsis stylifera* and *Metapenaeus dobsoni* are more prone to sloughening in the decreasing order. Fresh and brackish water species are more susceptible to this than their marine counterparts. This phenomenon has been found to be species specific and the content of connective tissues of the meat appears to play an important role in this phenomenon.

Prawns canned in brine should be free from cut end blackening to be worthy of export. This phenomenon has been shown to occur due to the presence of copper and iron which get converted to their sulfides during processing. Copper and iron come from ice, water, utensils, sodium chloride, citric acid etc. used in processing. In the case of marine prawns this could be prevented by maintaining the titratable acidity above 0.6% (as citric acid) in the fill brine. In the case of

"Fish Tech. No. 2" — a prototype of 32' OAL

"Sindhukumari" – Cheaper version of CIFT prototype boat - 50' OAL - built in 1966. 30% cheaper than the conventional hull.

back water prawns addition of 50 mg.% of ethylene diamine tetraacetic acid (disodium salt) in fill brine could completely prevent this.

Anticipating the diversification potential of the canned fish products the Institute has worked out standard methods for canning of different varieties of fish and shell fish like seer, sardine, mackerel, clam, mussel, crab, frog legs, anchoviella, tilapia, smoked sardine, eel etc. in different packing media like brine, oil, tomato sauce and mayonnaise sauce. Of special significance is a method worked out for canning sardine in its own juice, the 'natural pack', which besides dispensing with the costly oil retains the natural taste and flavour of the fish. Sardine cans processed by the Institute according to this method had been on sale at the 'Asia 72' Fair in Delhi.

When the Marine Products Export Development Authority introduced a cash subsidy scheme for export of canned sardine processed under unified process and with a common brand name the task of working out the process and demonstrating the same in one of the prominent canning factories was left to the Institute.

Freezing and canning methods of preservation of fish are particularly applied to products which are primarily intended for export. The problem of distribution of fish in the domestic markets also is very much important. Transportation of fresh fish to interior markets requires specially designed, at the same time inexpensive, containers in place of the bamboo baskets traditionally used. This is a problem which has been in the prime consideration of the Institute. It has designed modified containers like bitumen and kraft paper lined baskets, plywood boxes insulated with thermocole etc. which can hold iced and frozen fish in fresh condition during long distance transportation involving duration of 18 - 72 hours, which conclusion has been arrived at after carrying out extensive field trials with them.

Preservation of fish in refrigerated sea water holds has been investigated in detail. This method can profitably be employed in preserving the fish on board deep sea trawlers.

Sundrying is the oldest method, practised since time immemorial, for the preservation of fish. However, the products are not hygienic with low storage life and is practicable only during summer. The Institute has played its role in modernising this ancient industry by developing artificial dryers and working out easy methods. Worth mentioning are two processes developed for dehydration of prawns and fish using a drum dryer and tunnel dryer respectively. In the former cooking, drying and deshelling take place simultaneously in 3 - 4 hours to a final moisture content of 10%. In the latter using a technique of phased temperature programming at constant relative humidity fish could be dried to 20% moisture in 16 - 20 hours. Based on the data obtained on laboratory scale experiments designs of dryers of ½ ton capacity have been prepared and handed over to interested parties. Fish dryers designed to handle 1 tonne fish have been installed by a few commercial organisations. Conditions for drying different types of fish like mackerel, sardine, shark fillets, cat fish, lactarius, kilimeen etc. have been worked out.

Conservation of solar energy for dehydration of fish has been studied in

detail and a prototype of the dryer fabricated. Experiments conducted with the dryer show that a few species of the fish like anchovies, threadfin bream etc. could be dried in 14 - 18 hours.

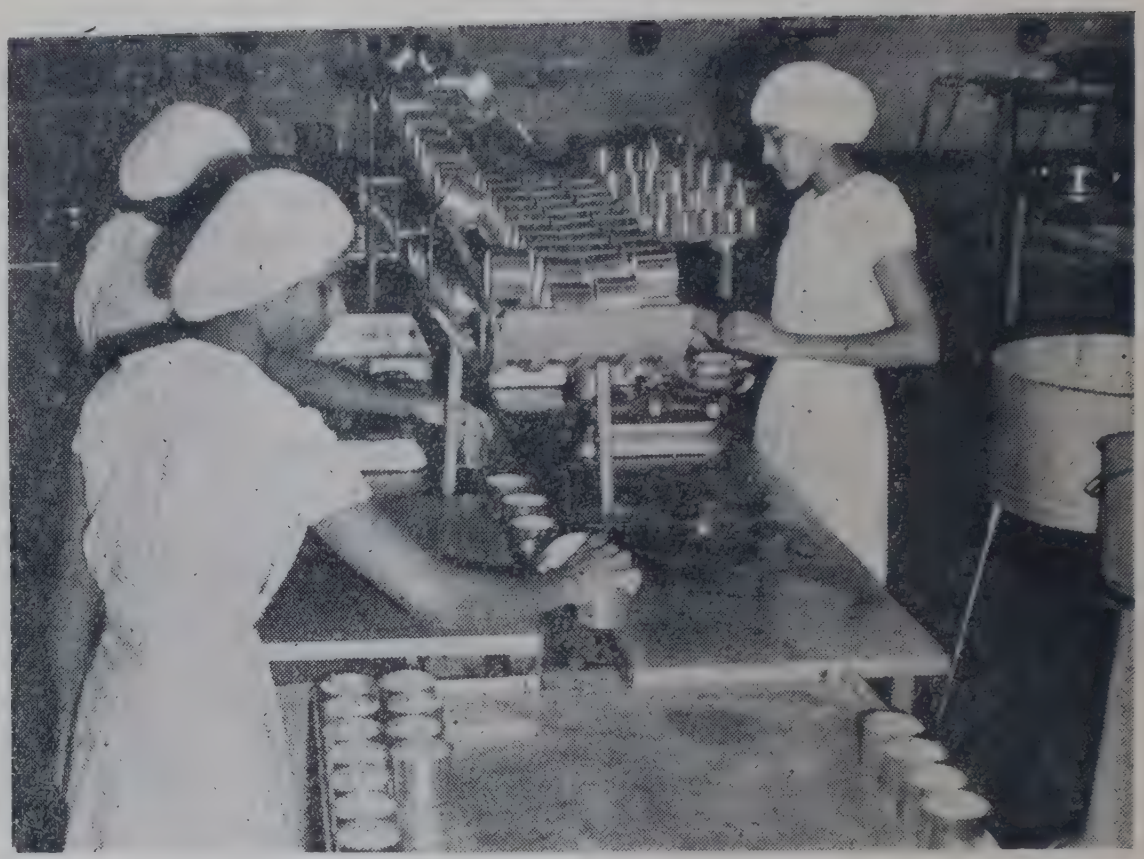
Freeze drying is a relatively novel field in the food preservation as such and particularly for fish. The Institute has experimented upon the freeze drying characteristics of different varieties of fish and prawns and formulated convenience foods like fish salad incorporating other ingredients with fish.

Considerable improvements have been brought about in the quality of dried Bombay duck processed particularly in the Saurashtra area as a result of the demonstrations conducted by the Institute. The process developed by the Institute for lamination of Bombay duck is now commercially employed for processing this product meant for export.

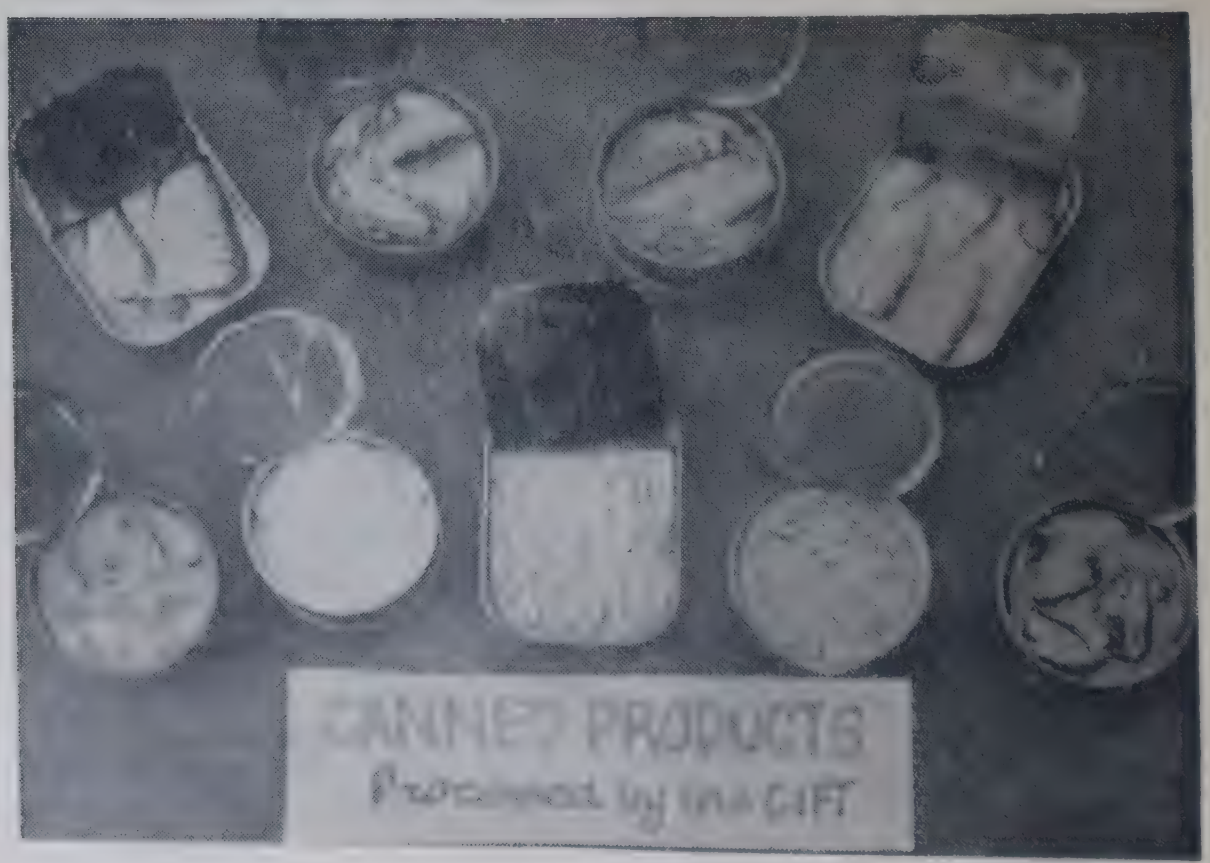
Irradiation using isotopes as a means of preservation of fish is, perhaps, the latest innovation in food preservation. The Institute in collaboration with Bhabha Atomic Research Centre, Bombay carried out extensive studies on the feasibility of irradiation in fish preservation and concluded that using low doze ionising radiations the storage life of fish and shell fish in ice could be extended for a considerable period.

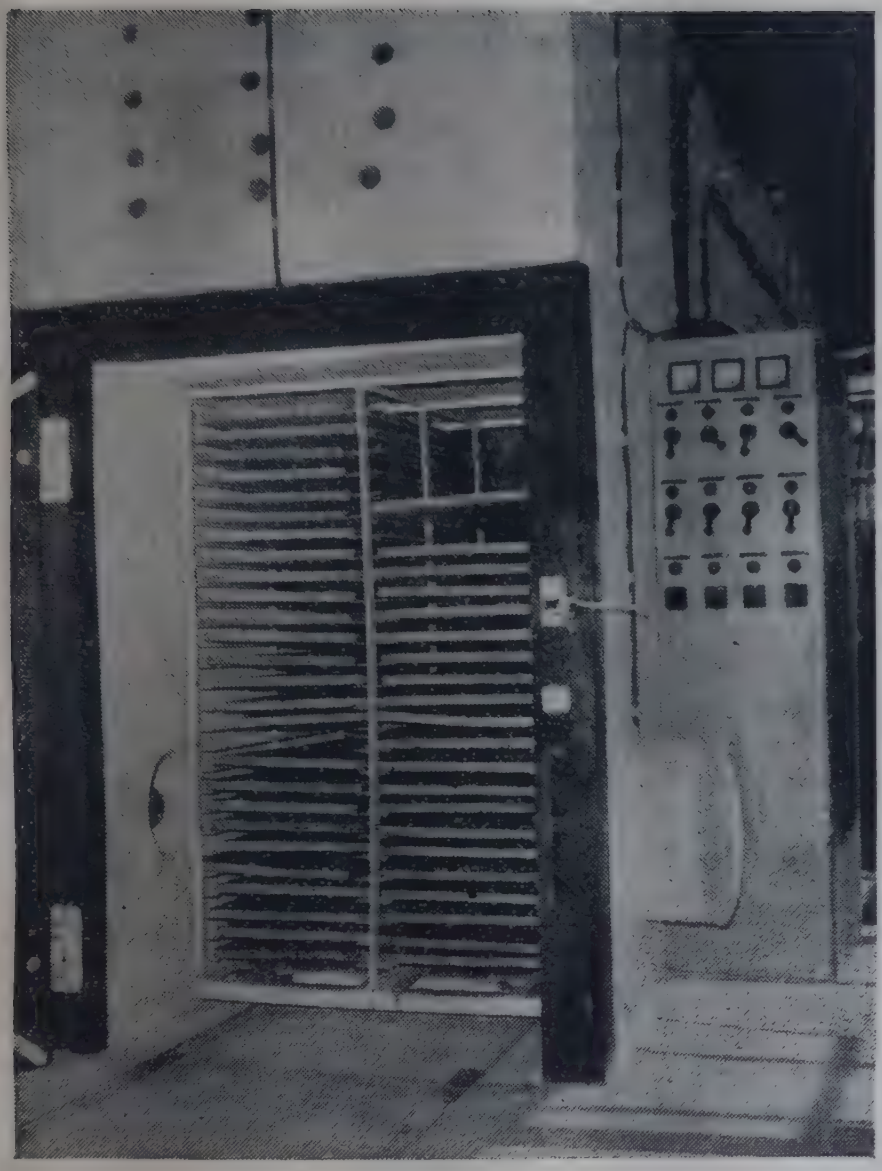
Hand in hand with sundrying was the method of curing practised all along the coasts for preservation of fish. Experience and expertise of generations of fishermen have backed the formulation of the processes adopted for the purpose. Using their ingenuity they had devised such methods as wet curing, dry curing, pit curing, Colombo curing etc. for the preservation of their excess catch. The products remained unattractive, unhygienic and the storage life was very poor and hence the industry was showing a diminishing trend. Revival of this industry is of great economic significance to the coastal fishermen. Therefore the Institute studied the problems in detail regarding shortcomings in the processes and as a result has been able to suggest to the industry various techniques by which cured products of better appearance, organoleptic properties and good storage life could be prepared. The most important outcome of such a research programme is the development of a simple technique of treatment of cured products with a mixture of 3% sodium propionate in refined salt in the proportion of 1 part of the mixture to 10 parts of fish. This treatment, besides preventing the spoilage due to fungal growth, red halophylic bacteria and humidity, prolongs the storage life of the cured products to 9-12 months. This process won an award from the Invention Promotion Board. The method worked out to remove urea from elasmobranch fishes like shark, methods suggested for improvement of the quality of 'masmin' and preparation of smoked sardine fillets etc. are other important achievements in this field.

Waste utilization forms an integral part of any industry and its significance in fisheries is more compared to any other industry taking into consideration the volume of waste turned out by it. Prawn processing has attained such a phenomenal growth that the waste from it alone is estimated to touch a figure of 40,000 tonnes per annum. Problems exist on the utilization of wastes from other fish processing industries and of the cheap miscellaneous fish which do not find ready market for fresh consum-



Commercial canning line in operation.





An end view of tunnel dryer (one tonne) of CIFT design installed at Integrated Fisheries Project, Ernakulam

ption or scope for consumption in processed forms in addition to this is the problem of economic utilization of sardine oil. Therefore research on aspects of utilization of these components forms a major activity of the Institute and has come out with significant achievements.

The Institute has worked out and demonstrated successfully a method of preparation of chitosan from shell and head waste of prawns which has been considered a versatile industrial raw material with scope for wide and varied application in sizing of textiles, water and wine clarification, as a base for chromatography etc. The method worked out also takes into consideration the isolation of proteins from the waste in a concentrated form. A liquid fertilizer suitable for the common crops has been prepared from prawns and fish wastes by a method of digestion with acid and subsequent neutralisation with alkali. Poultry feeds with appropriate composition for use as 'starter', 'breeder', and 'concentrate' also have been prepared.

Fish protein concentrate has been a topic for discussion among the nutrition-

ists all over the world wherever problems on combating malnutrition has arisen. The Institute has worked out a method for production of FPC from miscellaneous fish using the azeotropic extraction principle and the product has been accclaimed as one of the best produced within the country or abroad.

Of equal or more importance is a method worked out for the preparation of bacteriological peptone from 'trash fish' having comparable qualities with those of the imported ones. The peptones now used in the country in bacteriological assay media are almost exclusively imported in the light of which the achievement of the Institute becomes more significant. An ensiled product has been prepared from miscellaneous fish and extensive field trials were conducted with it after incorporating in cattle and poultry feed compositions. The product has been found to be highly nutritious.

There existed a trade in sardine oil along the south west coast of the country since very early days. The extraction procedure was very crude and the product had only very limited application in painting the country crafts. However, it was shown that the oil, if extracted on a scientific basis, has the characteristics similar to some of the vegetable oils used in industrial preparations. The Institute developed a method of extraction of sardine oil of extremely good physical and chemical characteristics. Research on the application of the oil for industrial purposes led to the conclusion that the oil after separation of stearin and proper modification could be used as a base for a number of industrial products. Few of such uses which the Institute has investigated and come out with successful results are, among others, as a vehicle for preparation of anti-fouling paint, in the production of factice (a mineral rubber used as a filler in the rubber compounding industry) and as a vehicle in printing inks.

The press cake obtained after extraction of sardine oil normally does not find any use except as manure because of the development of rancidity due to the presence of residual fat. However, it was shown that if proper care is taken fish meal suitable for cattle and poultry feed can be prepared out of sardine press cake. Similarly, from the cheap by-catches of prawn trawling, good quality fish meal can be prepared for which also the Institute has developed suitable methods. Other methods worked out for the economic utilization of low grade fish are for the production of fish soup in powder and tablet from, fish paste and fish hydrolysate flavoured with cocoa and sugar to use as a predigested food beverage with high protein content.

India exports a sizable quantity of shark fins every year. The fins, at the importing countries, are processed for the fin rays used in the preparation of expensive soups. If the fins are processed in the country for fin rays and the rays are exported it can reduce the bulk thereby effecting savings in freight. Moreover the rays fetch a much better price compared to fins. Considering this aspect the Institute has worked out a very simple and inexpensive method of extracting rays from the shark fins, either fresh or dry. The rays thus prepared have been noted to be among the best available in world markets.

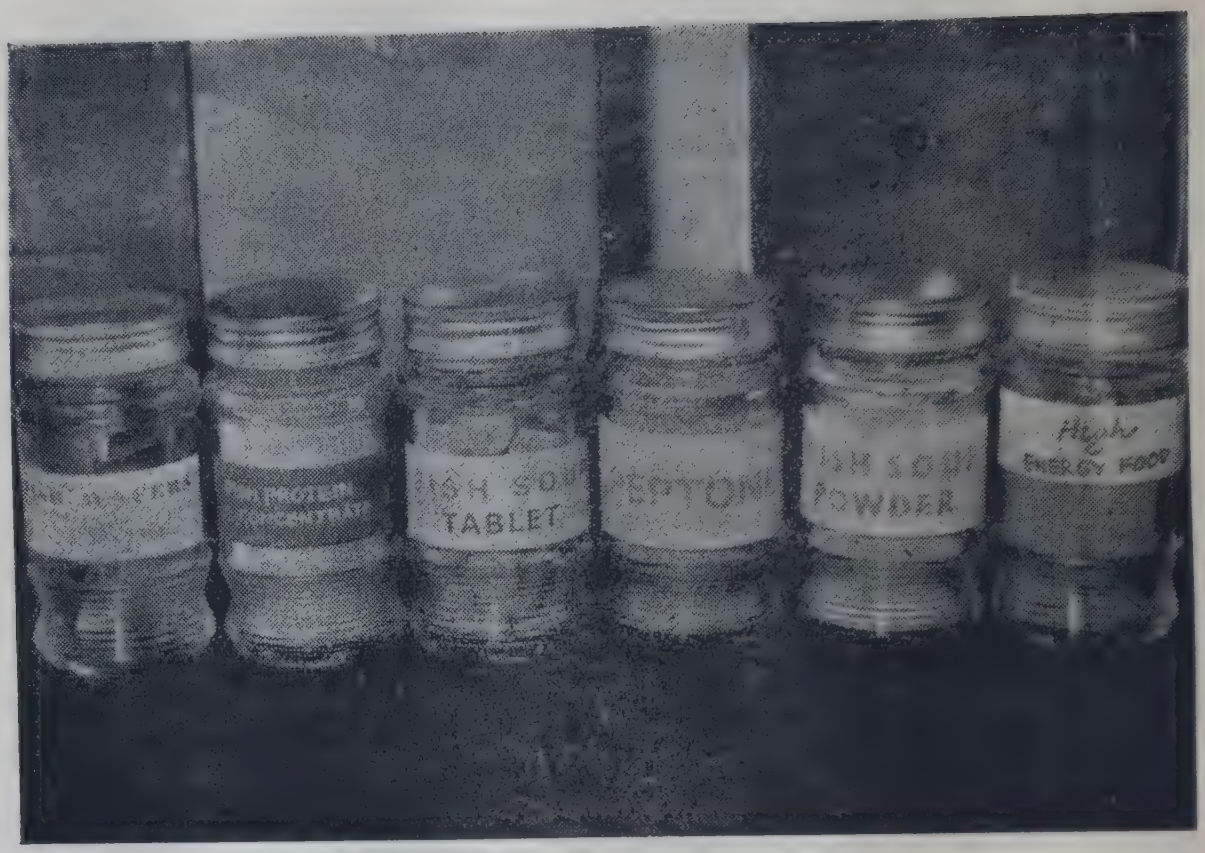
The sea food processing industry in India has made great strides in modernising it and making its produce more compatible with the quality criteria laid down by the buyers. In world markets our products had and still continue to compete with those of other countries which are far more technologically advanced. The buyers have every time been insisting on better physical and organoleptic properties and sound microbiological characteristics too. This suggests the need for a quality control system to ensure the wholesomeness and uniformity in the quality of processed fishery products. The Institute from its very inception had been maintaining a voluntary inspection scheme under which products of different processing establishments were tested for their quality and wherever found lacking in any of the aspects of quality, suggestions for improvements used to be given. The aspects of sanitation of fish processing plant including studies on microbiological characteristics of products at different stages of processing, utensils, equipments, ice, water etc. used for processing and even personal hygiene of the workers were covered, whereupon the possible sources of microbiological contamination could be traced and remedial measures taken.

When in order to maintain uniformity in quality and strict adherance to quality criteria, the Indian Standards Institution wanted to lay down quality specifications for fresh and processed fishery products it was mainly this Institute which, being represented in its Fish and Fisheries Products Sectional Committee AFDC 27 and its various Sub -committees, was responsible for drawing up the standards. This Institute has drafted standards for pomfret, threadfin and mackerel (fresh fish); prawn, frog legs, lobster tails, pomfret, threadfin, mackerel and seer (frozen); pomfret, prawn and mackerel in brine and oil, sardine in oil and its own juice, lactarius spp. in oil, tuna in oil, carb solid pack and in brine (canned); prawn pulp, dried and laminated Bombay duck, dry salted shark, dry salted threadfin (dara) and jew fish (ghol), dry shark fin and fish maws(dried); and under miscellaneous group code of sanitary conditions for handling and transport in fish industry (part 1 and Part II), recommendations for maintenance of cleanliness in fish industry and fish meal as live stock feed which have been accepted as material standards.

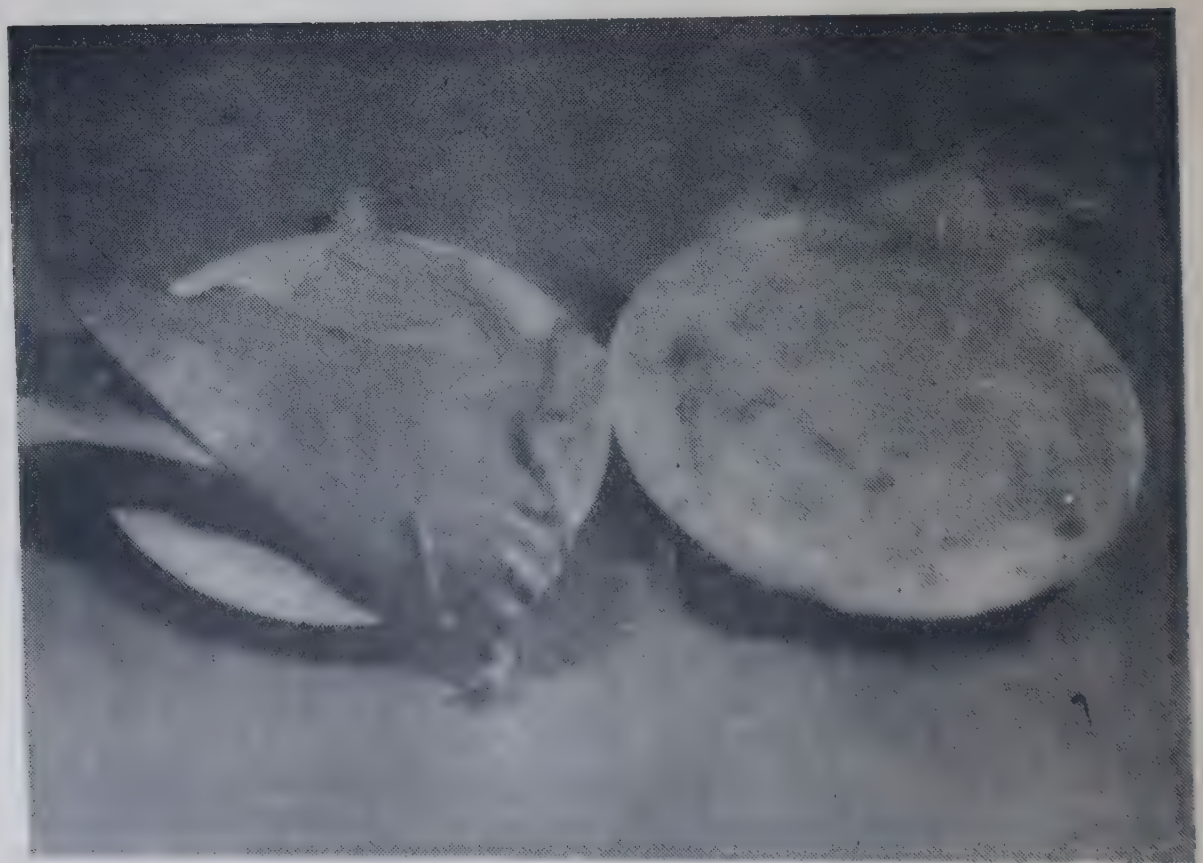
When in 1965 the Government of India introduced compulsory preshipment inspection of processed fishery products for export it was this Institute which was entrusted with the whole programme of inspection and issue of certificates. The credit goes to the Institute for having introduced a streamlined inspection system and enforcing it until May, 1969 when, based on a policy decision of the Government, the scheme was handed over to the Export Inspection Council.

Normally the industry would have had to make thorough changes in the set up to bring about the exacting requirements in quality particularly microbiological, when the compulsory inspection was introduccd. However, thanks to the efforts of CIFT which by its earlier voluntary inspection system had already groomed the industry, it was not difficult for it to submit itself for compulsory inspection when it was enforced

One of the most important requirements in the sea food processing plant with particular reference to microbial and organoleptic qualities of the products is observance of strict hygiene and sanitation. In the infancy of the industry there was



Products from miscellaneous fish developed by CIFT



SHARK FIN & RAYS

Quality control inspection of frozen prawn

Factory sanitation

no regular cleaning procedure followed in processing factories. Use of detergents and disinfectants was practically unknown. The Institute drew up a cleaning schedule using 'Teepol' as detergent and chlorine as disinfectant. The result has been phenomenal. It could take care of the bacterial problem to the required extent. A deodorant consisting of pine oil and a detergent has been developed for masking the foul odour emanating from the processing plants.

A proforma for assessment of sanitary conditions in processing establishments was prepared by the Institute, which can be used by technologists and enforcement authorities as a ready reckoner on sanitary conditions.

Prawn is processed mostly after peeling and deveining. The workers engaged in peeling and deveining develop blisters on their palms due to the constant contact with ice and prawns. The blisters have been found to harbour food poisoning bacteria, Staphylococci, which will contaminate the products handled by the affected workers. An ointment developed by the Institute containing salicylic acid, benzoic acid, potash alum and coconut oil has been found to cure such blisters overnight.

Total bacterial count had been considered as a reliable index of quality in the early sixties. However, the classical method of determining the total bacteria is time consuming since it takes not less than 48 hours. The Institute worked out a method of rapid approximation of total bacterial load which reduced the time to one to four hours.

In determining the bacterial quality of fishery products the presence of pathogenic and faecal indicator organisms is of major significance since these bacteria cause health hazards and are also indicative of the unhygienic practice in the handling of raw material. Therefore work had been taken up with priority on the incidence, isolation, survival and source of contamination of faecal and pathogenic organisms like Coliforms, *E. coli*, faecal streptococci, coagulase positive staphylococci, *Streptococcus pyogenes*. *Vibrio parahaemolyticus* and salmonella. Faecal streptococci is a better index of faecal contamination than *E. coli* because of their higher resistance to adverse conditions. *Streptococcus pyogenes* were not isolated from sea foods. *Vibrio parahaemolyticus* has been isolated from raw frozen shrimp. However they disappeared after a week at frozen storage temperature Coliforms and *E. coli* were found to be reduced by 90% during freezing and they disappeared after storage for 3 months at -18°C. The survival of faecal streptococci was to the extent of 65% during freezing and they survived subsequent storage. Coagulase positive Staphylococci survived freezing to a considerable extent. However, they got eliminated during storage extending 5 - 6 months.

When in 1967 Australia, the principal buyer of Indian cooked peeled and frozen prawns, introduced very rigorous bacteriological standards for this commodity, the industry was to face a serious crisis but for the timely action of the Institute which worked out a simple method involving sanitary precautions and use of chlorinated water in processing operations by which substantial improvement in microbiological quality could be brought about. Today our cooked frozen prawns are excellent in microbiological quality and rejection on this ground is unheard of since 1968.

Similar was the problem faced by the industry when in 1967 France introduced rigorous microbiological standards for frozen froglegs imported from India. The Institute rushed to the rescue of the industry and extended timely help. The method developed by the Institute also involved a humane element in that the live frogs were paralysed by a dip treatment in 10% brine for 10 minutes before cutting off the legs. This treatment removed the surface bacteria from the frog legs significantly besides doing away with the aweful sight of struggling of the carcasses of frogs after cutting off the hind legs. This 'humane method of cutting legs from live frogs' later received an award from the Invention Promotion Board. The method of processing of frog legs was modified by dipping the cut legs before skinning in 5% common salt solution containing 500 ppm. chlorine for 15 minutes. Our frozen froglegs were well accepted in all the importing countries till 1973, when the Food and Drug Administration, USA reported the incidence of salmonella. The Institute studied this problem and traced the skin, intestines and cloaca as the sources of contamination. Suitable remedial measures to overcome this also have been suggested by the Institute.

Technological research should be supported by data borne out of fundamental research in the respective fields. In deciding upon the processing parameters suited to a particular type of fish data on its biochemical and microbiological characteristics are essentially required. These aspects are given due importance in the activities of the Institute.

Because of its highly perishable nature fish requires extremely careful handling

A view of the Chemistry Laboratory

right from the time it is caught. Be it for fresh consumption or for conversion to processed products its quality is of supreme importance. This calls for a study of its spoilage pattern at the normal conditions of storage, say at normal air temperature, in ice or at intermediate refrigerated temperatures. From a systematic study of these aspects the Institute has been able to work out correct method of icing of fish, the proper ratio of ice to be maintained and the storage life of different fish and shell fish at different temperatures of storage. This has largely helped the industry to adopt suitable method for the preservation and subsequent marketing of fish in good condition.

Organoleptic evaluation is, by far, the most critical criterion in assessing the edible quality of any food product and is more so in the case of fish, setting aside its nutritional quality. Flavour is an important factor in determining the organoleptic qualities. Therefore the Institute has paid due attention to this important factor and carefully studied the components responsible for producing flavour like sugars, sugar phosphates, nucleotides etc. in fish and shell fish. Changes occurring in them during ice storage have been studied and correlated with the resultant flavour changes. Another factor affecting the flavour of fish is lipids and the changes occurring in them during storage. Some of the highly unsaturated fatty acids present in lipids (sardine oil) are reported to have pharmacological importance also especially in the control of cholesterol level in blood, which is a significant finding considering the easy availability of sardine oil. Therefore assessments have been made on the qualitative and quantitative distribution of phospho and neutral lipids in different varieties of fish using the technique of gas-liquid chromatography. Oxidative changes in lipids leading to rancidity and consequent development of off flavour in fish during freezing and frozen storage also have been studied in detail.

Nutritive value of fish and shell fish is attributable to the content of high quality proteins in them. Myofibrillar proteins, the major group among the fish muscle proteins, are easily susceptible to denaturation during ice and frozen storages. Denaturation brings about irreversible changes in texture, flavour and nutritional properties of fish. Assessment of the extent of changes brought about in different groups of proteins in fish and shell fish during ice and frozen storage thus forms an integral part in evaluation of the nutritional qualities of preserved fish. With this in view extensive studies have been carried out on the electrophoretic pattern of the sarcoplasmic and myofibrillar proteins of different fish and shell fish during ice storage as also frozen storage. Protein degradation caused by proteolytic enzymes in common tropical food fishes including shell fishes is a major field of study. The proteolytic enzymes present in these tropical fishes in general are active in the acid range of pH (3-4.5) and are mostly activated by - SH groups. The enzymes in visceral portion have manyfold the activity as compared to those of muscle tissues and are highly active releasing high amounts of amino acids by proteolysis favouring microbial proliferation and spoilage.

Addition of formaldehyde causes denaturation of proteins and the denaturation is proportional to the amount of formaldehyde added. The possibility of protein denaturation caused by formaldehyde liberated from trimethyl amine oxide

(TMAO) during storage of marine fishes has been elucidated. Studies on similar lines with unsaturated fatty acids have shown that they play a major role in denaturation of proteins especially in the case of fatty fishes in ice storage or frozen storage, as these acids are preferentially released into the system as they constitute the major fraction of the phospholipids and the latter are highly susceptible to hydrolysis during storage of fish.

Melanosis or the black discolouration often met with in fresh, iced or frozen prawns, though in no way affects its nutritive value, is of paramount importance as far as the appearance of the product is concerned. The Institute did not lose time in identifying the causes for it and established that it is due to the action of certain phenolase enzymes like pyrocatecholase and tyrosinase present in prawns. The enzyme activity of the head juice is 5-20 times greater than the muscle juice depending upon species. This suggests that the phenomenon can be controlled to a significant level by beheading the prawns immediately after the catch.

On boiling prawns develop an attractive carotenoid colour which primarily determines its consumer appeal, particularly in dry, cooked frozen and canned prawns. This colour on storage fades and gives way to an undesirable yellow/brown colour. To work out a process to prevent this a fundamental knowledge of its chemical characteristics is essential. It has been shown that the pigment system consists mainly of astaxanthin and relatively smaller amounts of astacin, lutein etc.

In any food product, particularly a highly perishable one like fish, either raw or processed, the nature of the bacterial flora associated with it largely determines its state of freshness, shelf, life or wholesomeness as food. Different types of media are required for the detection and enumeration of different bacteria. It has been proved by experiments that for the enumeration of total bacterial count in fresh or iced fish a simple medium like 'sea water agar' is satisfactory, whereas a medium containing complex nutrients is necessary for recovery of organisms from frozen fish samples where micro organisms have been subjected to a cold-shock. Bacteriological investigations have brought to light the pattern of changes in the qualitative and quantitative composition of the microflora associated with fresh and ice stored fish and shell fish as well as with different types of processed products. Though there is an initial reduction in the bacterial load during ice storage, after 2-4 days a slow and steady increase takes place due to the growth of psychrophilic bacteria. At the advanced stages of spoilage the microflora consisted of *Pseudomonas* spp. in case of sardines and *Pseudomonas* and *Achromobacter* spp. in prawns.

In frozen fish there takes place 60 -90% reduction in the bacterial count immediately after freezing and subsequent storage at —18°C for 2-4 months resulting in the establishment of the residual flora consisting mainly of gram positive organisms like *Micrococci* and *Bacillus* spp. The cold sensitive gram negative rods originally present had mostly been killed and the viability of the remaining greatly reduced.

The beneficial effects of using antibiotic ice incorporating chlortetracycline (CTC) for the storage of fish and shell fish have been established after several

trials onboard fishing vessels as well as in subsequent ice storage. Prawns dipped immediatlely after catch in a solution containing 25 ppm. CTC and stored subsequently in ice incorporated with 5 ppm. CTC keep well for 6 days more than the normal ice stored sample.

But for the rancidity problems, similar results could be obtained with sardines also. The residual flora at the end of such storage has been found to consist of mildly proteolytic *Pseudomonas* and *Achromobacter*. The formation of slime during storage also is less compared to ordinary ice storage. The residual antibiotic in samples so preserved gets destroyed to an undetectable level on cooking.

Isolation and characterisation of the organisms responsible for spoilage odours in canned fish and shell fish have been successfully carried out at the Institute. These investigations have helped in selecting the processing parameters required to eliminate the hazards due to the specific bacteria responsible for spoilage.

Micro organisms belonging to the *Clostridium* spp. are known to cause severe food poisoning. A survey conducted by the Institute showed their occurrence in the environs of processing factories as aslo in the guts of prawns. The latter observation is of significant importance since it is suggestive of the occurrence of such bacteria in the bottom sediments in the sea.

Highly potent and still more dangerous is the pathogen *Salmonella* which is occasionally encountered in fish and fishery products in relatively small numbers. Their detection and isolation required observance of careful and exacting conditions in handling, formulation of the specific media etc. which the Institute had successfully worked out. The Institute has gathered a good volume of data on the content of vitamins and amino acids in fish and fishery products by the microbiological assay method which forms a regular part of the work.

In order to maintain efficiency and cut down cost of overall operations a great number of instruments are in use in the advanced countries. The requirements of such instruments within the country used to be met by import. The Institute has had its share in designing and fabricating many of such instruments used in fishery industry and research making use of the talent available within the country.

Fuel is a major item of expenditure in the operation of boats. Any abnormality in the consumption of fuel reflects on the condition of the engine. The Institute developed a simple instrument for accurately measuring the consumption of fuel by the engine under different conditions and carried out extensive tests with success. An instrument for measuring pitch and blade thickness of marine propellers has been developed and its prototype fabricated.

Various factors influence and contribute to the efficiency of operation of fishing gear. Precise data on these factors are required for the designing of fishing gear. Therefore the role of measuring and testing instruments in fishing gear research and operation need not be emphasized. The Institute has gone on record as having designed; fabricated and tested under actual field conditions many of such electronic instruments which include 1) underwater tension meter, 2) depth telemeter, 3) angle of attack meter, to measure 'angle of attack' of otter boards, 4) tilt meter to measure the 'tilt' of otter boards, 5) temperature

Multi-signal Telemeter

& salinity telemeter, 6) multisignal telemeter link between net and boat to measure all important operating parameters of trawl net, 7) ship installed tension meter to measure trawl warp tension, 8) boat speed measuring instrument and 9) mesh distortion gauge to measure the distortion in the shape of mesh of a fishing gear under operation.

Of these instruments, the 'depth telemeter' won an award from the NRDC and technical know-how for this and a few other instruments are being released by them for commercial exploitation.

While the above instruments are designed for helping the fishery industry and research on the fish production side a number of them have been developed for operation on the fish processing side as well. Owing to the prominence enjoyed by prawns in the modern fish processing industry little or no care was being bestowed upon the problem of utilising the underutilised varieties of fish obtained as the by-catch in trawling for prawns. When the importance of utilization of the by-catch was realised there remained a gap in the availability of required type of machineries for their proper utilization. Realising this the Institute is engaged in the development of a number of equipments such as meat picking machine, nobbing machine, filletting machine etc. and prototypes of some of these have already been made.

Maintenance of correct percentage of salt in the blanching brine in canning operations for prawn is very important for obtaining uniformity in quality. When the same brine is to be used for subsequent blanchings it has to be replenished to the original strength with added common salt. To calculate the quantity of salt to be added the strength of the brine should be known. For this a simple electronic measuring instrument which gives direct reading of the concentration of brine called 'Brinecon' has been designed, developed and tested in actual field conditions. Similarly a 'Brine dispenser' has been developed for dispensing correct quantity of brine to the cans automatically when they pass over a conveyor belt.

The other electronic instruments developed include a 'Brinometer' which gives direct reading of the percentage of salt in dried fish, a penetration thermometer which can be used for measuring the temperature of frozen blocks of prawns/ fish, and a "dielectric thawer" for quick thawing of frozen blocks of prawns.

The Institute also attends to statistical problems related to the fishing and fish processing industry. It has carried out studies on formation of 'lots' for pre-shipment inspection of frozen prawns and also on the adequacy of I.S.I. standards for the product in this respect,

and made recommendations for improvement. The comparative efficiency of boats built to C.I.F.T. design was studied in respect of different sizes. Control charts for fill-weights in canning factories were worked out to help the factories in standardization of filling procedures of cans. The effect of fluctuations in ex-vessel prices of local shrimp in U.S.A. on imported Indian frozen shrimp was studied in the case of a few selected size-grades to enable the Indian exporters to forecast the market trends. The percentage yields of final product from a given quantity of raw material were worked out for a few varieties of processed fishery products. The rates of turn over of work at different stages in the processing factories were also worked out.

The purpose of research and development activities will be served only when the findings are advantageously put to application in the actual field. The Institute has many programmes in its activities to attain this ultimate goal. One such activity is imparting training, theoretical and practical, in different fields of fishing and fish processing. Till the setting up of the Central Institute of Fisheries Education, Bombay and Central Institute of Fisheries Operatives Cochin/ Madras, the C I F T used to organise regular training courses where personnel deputed from State Fisheries Departments and those deputed under Colombo Plan from countries like Phillipines, Sudan, Zanzibar and Burma were given training in boat building, gear designs, fishing methods, fish processing and quality control. Adhoc training of 1-3 months duration in specific fields are being given, on specific requests, to representatives of State Fisheries Departments and fish processing industry.

Training Classes on Fishing Gear

Refresher training course on fish processing progress

CIFT Pavilion at the All India Agricultural and Industrial Exhibition at Cochin

Since 1973 the Institute has started a 'Refresher training course' for imparting advanced training to technical personnel in fishing and fish processing establishments. One hundred and fifty eight candidates have thus been trained in different branches of fishery technology upto the end of 1975.

Open house discussions and demonstrations on different aspects of fish processing technology including sanitation have been conducted for the benefit of the industry at different centres. For the benefit of the common fisherman film shows on different aspects of his interest were regularly held at several fishing villages, which have been proved to be highly successful. Querries on any aspect of fisheries technology are being promptly answered. Besides, there is an analytical service where samples of fishery products are analysed and the data supplied with suggestions for improvement of the quality. Analysis of samples of water, detergents and disinfectants used in fish processing establishments is regularly carried out under this scheme. In addition the Institute issues leaflets and booklets on many aspects of fisheries technology which are given free to the interested parties.

The Institute has taken part in many exhibitions and its stall has always been a major attraction. This has largely helped the people to understand the importance of the activities of the Institute. The Institute has won trophies for the good and attractive maintenance of its stalls in such exhibitions.

The foregoing gives a short account of the activities of the Institute in the various fields of research, development and extension and its creditable achievements in different spheres of work. True, much has been done; but more remains to be done. With all the Divisions of the Institute having come under one roof and with better co-ordination and co-operation between themselves and the industry, let us hope, the Institute can play a still more significant role in the development of the fishery industry of the country.

Do not engage in petty quarrels, work for the unity of the motherland.

- Subhas Chandra Bose

Give up jealousy and conceit. Learn to work unitedly for others.

- Vivekananda

No greater nuisance to a country than an arguer.

- Tagore

A PERSPECTIVE OF FUTURE GROWTH OF INDIAN FISHERIES

K. A. SAVAGAON[1] & A. SREENIVASAN[2]

With the unabated growth in world population without commensurate progress in food production, feeding the hungry millions has become a problem of highest priority for most countries. While a few of the technologically advanced countries, which also have controlled birth rates, grow surplus food, the under-developed and developing countries, representing two-thirds of the world's population and having high birth rates, are far from self-sufficient in food supplies, in spite of some progress in agricultural technology. This disparity in the availability of food between the advanced and developing countries has encouraged some countries with surplus food to use food as a political weapon. Realization of internal and external repercussions of food shortage has forced the deficit countries to strive for utilization of all the natural resources available to them for procuring food. Inevitably, the oceans which, apart from being rich in minerals and oil, have been providing food to coastal populations from time immemorial, have come for increasing attention.

Despite the fact that over seventy per cent of the global surface is covered by the oceans which are estimated to produce at least 2000 billion tons per year of sea foods and can sustain an annual harvest of 250 million tons of fish with the help of known technology, only two per cent of the world's food requirements are obtained from this source. Here again, the share of the developing countries is very low. Taking our own country, with a coastline of some 3,500 miles, a fishable area of 100,000 sq. miles and an estimated potential of 12 million tons per year, the annual catch is just about 1.5 million tons. The reasons for the economic waste of such enormous untapped resources, at a time when there is compelling need for augmenting food supplies and animal protein, are many. At the social level, it may be just ignorance, prejudice or religious customs. At the operational level, it could be lack of understanding of marine environment, lack of skilled man-power, lack of know-how or the means to achieve total harnessing of the existing resources efficiently and

1. Britannia Sea Foods, Thana 4, Bombay.
2. 72, Pali Hill, Bombay 400 050

(Dr. A. Sreenivasan was Chairman of the Achievement Audit Committe of CIFT. - Ed.)

on a sustainable commercial basis and last, but not least, lack of suitable methods of preservation to enable distribution of fishery products from coastal areas to relatively inaccessible inland regions, in a form appealing to the consumer.

Recognition of these needs by our Government is implicit in the small beginning it has made in initiating the programmes to equip the country for exploitation of inland and oceanic fishery resources through the establishment of various institutes such as National Institute of Oceanography, Central Institute of Fisheries Technology, Central Marine Fisheries Research Institute, Central Inland Fisheries Research Institute, Central Institute of Fisheries Education, Central Institute of Fisheries Operatives and Indo-Norwegian Project. Sustained efforts on the part of these pioneering institutions have brought in modernisation and steady growth of fisheries industry to the extent of raising India to the sixth place among the fishing nations of the world.

The Central Institute of Fisheries Technology, with its various sub-stations, has played a pivotal role in this achievement. When the fisheries industry in the country was almost nonexistent, it provided expertise and leadership in organising modernised fishery industry and technological assistance in establishing export market for Indian sea foods on sound basis. Thus it has designed mechanised fishing boats, various types of fishing nets and fishing gears, all suited to our coast and fishery. It has worked out substitutes for craft components to improvise and economise them. It has developed several electric and electronic gadgets for use in commercial fishing operations. It has standardised freezing canning and curing processes for fish and shell-fish of commercial importance. It has developed by-products from fishery wastes. It has produced cheap containers for distribution of iced fish. It has introduced to fisheries industry plant sanitation and hygienic methods of handling and processing of sea foods. These are but a few of the significant achievements which have contributed to the all round development of fisheries industry in India, earning the full respect of the industry and a position of authority for the Institute.

It must, however, be realised that the sailing all these years has not been smooth. Funds have not been made available to equip the Centre and its substations adequately. No pilot plant facilities have been made available to scale up the laboratory developments; as a result, many a product and by-products developed by the Institute have not been converted into commercial propositions, since, in India, industries are chary of trying anything short of fool-proof projects. Some at least of these difficulties are expected to be removed shortly if the recent recommendations of the Institute's Achievement Audit Committee are implemented by the ICAR.

With all the progress that has been made, the Indian Fisheries Industry is as yet almost totally export oriented. There too, the main emphasis has been on freezing and canning of shrimp. Trash fish, coming with the shrimp catches is under-utilised or unutilised. Other table varieties are harnessed only insufficiently and are sold only in nearby local markets, mostly in fresh form. This unicentered policy of the industry has made the trawler operations uneconomical and has also resulted in utilisation of the installed capacities of freezing and canning units

to a meagre 25 per cent. This has also led to over-exploitation of shrimp resources to the detriment of the industry. Diversification of products is a growing need for the industry, not only to make full utilization of available plant capacity, but also for efficient and economical management of the resources at hand. With the availability in the Indian Ocean of a large variety of commercially acceptable fishes, crustaceans and molluscs, this is not an impossible task. This, however, calls for extensive efforts in locating and defining new fishing grounds, introducing vessels suited to deep-sea and high-sea operations and developing advanced as well as specialised gear designs for demersel, pelagic and bathypelagic fishes based on their behavioural characteristics. Increased productivity of selected species by cultivating or farming of intensively harvested grounds would also help in meeting the industries' requirements to some extent. Besides, use of fresh water sources, including the paddy fields, for artificial fish culturing offers enormous scope for augmenting the fisheries resources for industrial use.

The pre-occupation of the organised industry with export market has resulted in the neglect of the needs of the common man for food and animal protein. Per capita consumption of fish in India has still remained dismally low at about 2 kg. per year, compared to 9 kg. in Ceylon, 33 kg. in Korea, 49 kg. in Japan and 65 kg. in Norway. Processed sea foods are out of reach of the common man's pocket, while fresh fish - whatever is caught by the small fishermen – do not reach him away from the narrow coastal belt. The primary need therefore, is the development of distribution systems that permit transportation of high quality sea foods from coastal regions to hinterlands either in ice or at ambient temperatures after appropriate salting, cooking or other processing procedures or, preferably, in frozen conditions using suitable insulated containers. In this manner, the idle capacity of the existing processing plants could also be profitably used for processing sea foods other than shrimp for in-country consumption. Radurization process - use of low dose gamma irradiation to eliminate spoilage micro-organisms - with or without combination of mild heat, has been shown, at the least, to double the shelf-life of fish and could very well prove to be suited for in-country distribution of many sea foods. Preservatives in ice or on fish in conjunction with suitable packaging practices could also go a long way in achieving wider distribution of fresh fish. New low-cost products could be developed from trash fish varieties. Wider acceptance of new products depends, besides the cost factor, on whether they conform to the food habits of general population and are appealing to their taste. Fish protein concentrates, even with all their nutritional advantages, have not made any headway, mainly because of their lack in general appetite appeal. Fish cakes, fish *kheema* or the likes, on the other hand, may well be accepted by the masses.

Today, the CIFT has changed its shell, even as the crustaceans moult to keep themselves fit to fight the environmental hazards. In its well equipped and newly acquired environment, the Institute may now be expected, more than ever, to be in a position to lead the Indian Fisheries Industry towards progress and prosperity. Undoubtedly, the Institute, together with its regional stations, has a vital role to play in the economic development of the Fisheries Industry and that of the country through increased exports. It shall also have to be equally concerned with the improvement of the diet of the people throughout the country by making sea foods available to them in plenty and in acceptable forms.

Permanent campus of the Central Institute of Fisheries Technology - A perspective in retrospect

The Institute came into existence with the establishment of its Craft and Gear Wing in Cochin in 1957 which was accommodated in three rooms set apart from the then Offshore Fishing Station of the Government of India. When the Processing Wing was started in the following year accommodation for it was found in a rented building at Ernakulam. There took place a gradual expansion in the activities of the Institute which necessitated and registered a steady growth in the number of personnel, equipments machinery etc. More and more laboratory facilities were to be added with the increasing activities of the Institute, so also space for the setting up of pilot plants. To meet the increasing demand for floor area more and more rented accommodations were added. However, at no time the addition of floor area was commensurate with the actual requirements. The difficulty in acquiring a building large enough for the requirements of the whole Institute or sufficient number of buildings with the required combined floor area in a single location made it necessary to take on rent buildings spread over in different localities in the city. Construction of all such buildings had been intended for residential purposes and therefore lacked the facility for setting up scientifically laid laboratories and for providing such other facilities as required for a technological laboratory. These factors had always remained great impediments in the progress of the Institute.

The necessity of a permanent laboratory-cum-office building of its own to the Institute had been under very active consideration since its very inception. The first positive approach in this respect took place in as early as 1960 when 4 3 acres of land in Willingdon Island was acquired on long lease from the Cochin Port Trust for the construction of the building. Original idea was to provide space for the Offshore Fishing Station, Cochin and the Sub-station of the Central Marine Fisheries Research Institute then functioning at Ernakulam along with Central Institute of Fisheries Technology in the same building. Later both the C M F R I and Offshore Fishing Station opted to move out since they acquired their own plots for construction of buildings.

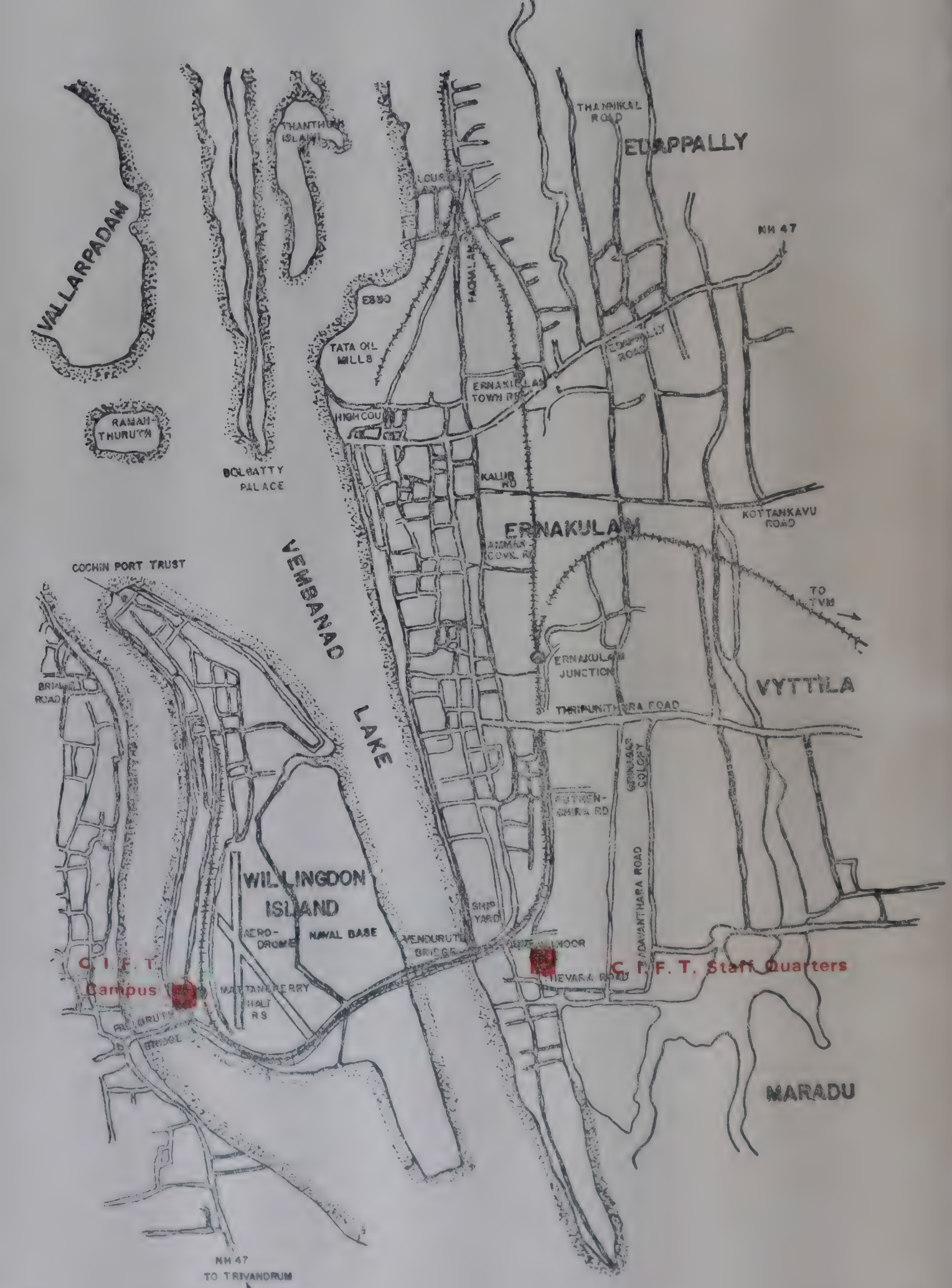
The Central Public Works Department (Food) was entrusted with the task of designing and constructing the building, who made an estimate of Rs. 43.5 lakhs in 1963 for the construction. Due to paucity of funds this was pruned to Rs. 28.5 lakhs and was sanctioned

in 1964. Consequently M/s. Simplex Concrete Piles (India) Pvt. Ltd., Madras was entrusted with the work of pile foundation. They had almost started the work when abruptly it had to be suspended owing to the economic stringency experienced as a result of the eruption of the Indo-Pakistan war of 1965. No sooner did normalcy prevail once again than the efforts were renewed to revive the construction programme. On the basis of a revised estimate prepared by the CPWD the Indian Council of Agricultural Research, to whose hands the administrative control of the Institute had been transferred by then, sanctioned an amount of Rs. 58 lakhs for the construction during the year 1971. The construction was originally expected to be completed within 30 months; however delay occurred at various stages due to various reasons.

The building as it stands today commands a prestigious position by virtue of its size and location. Its overwhelmingly impressive appearance spread over a wide area in a strategic position overlooking the Cochin backwaters cannot escape anybody's eyes. Just on the opposite side of the backwaters do come up the Cochin Fishing Harbour, in and around which area are scattered most of the fish processing establishments in Cochin. This implies that CIFT in its new surroundings is situated only a stone's throw away from the industrial hubub, service to whom constitutes a major part of the functions of the Institute. It is easily accessible by any sort of conveyance being situated alongside the National Highway No. 47, the port of Cochin, the Terminus station of the railway from Cochin and the Cochin Civil Air Terminal.

The total plinth area of the building is about 5000 square metres. The building is planned and constructed in six wings, five wings extending in all directions and the main entrance hall and the stair case landing being housed in the Central sixth wing. Though the building has only two storeys each on all the wings the design is such that wing No. 1 facing south and wing No. 3 facing north can have three storeys each and the Central sixth wing can have four storeys.

Adequate care has been taken in providing the laboratory facilities suitable for the work expected out of different sections. All the laboratory space is well ventilated and the day light pours in all day long. Other facilities provided in the building are a spacious gear fabrication hall, a workshop which is sufficiently equipped to cater to the needs of all the Divisions of the Institute, a pilot plant room where the pilot plant machineries and equipments are put in operation, a processing hall for the preparation of fish prior to different methods of processing, two cold rooms maintained at the temperatures - 20°C and -1°C respectively, a dark room suitable for all photography works and a museum. The importance of reading in the research and development activities need not be overemphasised. Therefore there is provided a very spacious library hall in the quietness of which one can spend the required time in containing the latest informations on the subject of his choice. Equally important in an Institute of this type is the requirement of a hall where scientists can meet, discuss and provide occasional lectures on specific subjects. One room has been earmarked for this purpose also.


VALLARPADAM
THANTHONI ISLAND
RAMAN THURUTH
BOLGATTY PALACE
THANNIKAL ROAD
ELAMPALLY
NH 47
TATA OIL MILLS
ERNAKULAM TOWN RS
HIGH COURT
KALIS RD
KOTTANKAVU ROAD
ERNAKULAM
COCHIN PORT TRUST
VEMBANAD LAKE
TO TVM
ERNAKULAM JUNCTION
VYTTILA
THRIPUNITHURA ROAD
WILLINGDON ISLAND
AERO-DROME
NAVAL BASE
SHIP YARD
VENDURUTHY BRIDGE
ADAVANTHARA ROAD
C. I. F. T. Campus
C. I. F. T. Staff Quarters
MATTANCHERRY HALT RS
NH 47
TO TRIVANDRUM
MARADU

Side by side with providing the atmosphere and facilities conducive for the intellectual work no effort has been spared in providing facilities for the recreational and similar activities for the staff. One of the most important among them is a canteen. There had been two independent tiffin rooms functioning at Cochin and Ernakulam which have been merged and a canteen formed. The facilities for canteen provided in the new building is adequate enough to meet the requirements of the entire staff. The recreation club of the Institute is a forum for the entire staff for involving themselves in the cultural and social activities. The members of the CIFT recreation club have distinguished themselves by winning laurels in the competitive activities like sports, dramatics and other cultural activities held every year under the auspices of the Central Services Welfare Board. In order to render more useful service to the staff and to intensify its activities the recreation club has also been provided with a room. Sufficient open area is available in the campus which the recreation club can make use of for out-door games.

While acquiring the land for construction of the building the future requirement of space for expansion also had been anticipated. The vacant area now left unused will, in future, be used for the construction of a boat building and repairing yard with slip way and other accessories, a fire proof shed for accommodating such of the machineries and pilot plants requiring fire proof covered area.

During this auspicious occasion of the inauguration of the building we record with sincere thanks the services rendered by the Central Public Works Department and their architects and engineers who have associated themselves with the design and construction of the building, the various contractors connected with the construction and supply of the various stores required for the work and the workers who have sweated in the actual work for giving body and shape to the building.

Truth nourishes the soul; untruth corrodes it -

Gandhi

A born democrat is a born disciplinarian -

Gandhi

Do not destroy, break not, pull not anything down, but build -

Vivekananda

STAFF WELFARE ACTIVITIES

Contented staff is the best asset of any organisation. This is one of the guiding principles behind the formulation of policies for the proper personnel management. Apart from the different measures the government has taken there is much which the Institute can take up within its frame work for the welfare of its staff. The Institute had always been eager to adopt and implement with full sincerity such of the policies formulated by the department for the general welfare. Welfare fund, canteen and the recreation club require special mention among the welfare activities undertaken by the Institute for its staff.

WELFARE FUND

As a measure to offer pecuniary help to the staff in some unforeseen circumstances a Welfare Fund had been set up in the Central Institute of Fisheries Technology with effect from 27-4-1962. The fund was set up by regular voluntary contributions made on monthly/annual basis by the members of the staff, the rate of contribution being determined according to the pay drawn by them. The objective of the Fund was to provide financial assistance in the form of loans or gifts to members who make regular contributions for the following purposes:

a) to provide financial assistance to the family of the member in the event of his death, to meet its immediate financial needs;

b) to provide financial assistance to a member in case of his prolonged illness;

c) to provide financial assistance to a member suffering from unforeseen misfortunes; and

d) for other purposes as may be deemed necessary by the Managing Committee of the Fund.

The Fund is managed by a committee consisting of the Director of the Institute as its chairman, seniormost Officers of the Processing and Craft and Gear Divisions as members and Administrative Officer and Superintendent respectively as secretary and treasurer.

Any member of the staff who is a regular contributor to the Fund can apply for assistance from the Fund in circumstances covered by its objectives. After assessing the merits of such application the Managing Committee can decide upon the extent and type of assistance to be given in the concerned case within the limits empowered by the constitution of the Fund.

The Fund has raised great enthusiasm among the members of the staff. All the staff members including those at the various sub-stations and units are members of the Fund and make regular contributions.

In the years passed the occasions had been many when the Fund reached timely help to several of the members of the staff or their families in hours of need. The first recepient of assistance from the Fund was the wife of Shri. Dominic; she received a grant of Rs. 300/-. Shri. Dominic was a carpenter in the service of the Institute who died untimely. This happened just two years after the inception of the Fund. Financial assistance ranging from Rs. 50/- to Rs. 200/- have been given from the Fund to the members of staff or their families, the pecuniary circumstances being caused by such diverse reasons as prolonged illness, accidents caused, on the subsequent treatments, death etc. Sofar the Fund has extended such financial assistance to ten members of the staff.

The Welfare Fund has been found to be a very useful one as judged by its past performances and it is hoped that the maintenance of the Fund will be persued with renewed vigour and enthusiasm.

CANTEEN

The rejuvenating effect of a cup of hot tea/coffee on body and mind after a few hours, dreary work need not be told to realise. In the early stages when the Institute was young and its staff few the necessity of a canteen run by it was not seriously felt. With the steady increase in its staff and the absence of a reasonably good hotel or restaurant nearby the Institute rose to the awareness the necessity to have a canteen or at least a tiffin room within its campus. Governmental assistance in the form of loans and subsidies were available for running tiffin rooms or canteens but this could not be made use of in the absence of any space for accommodating it. However, when in 1967 the Institute took over an additional building in Ernakulam to house some of its laboratories some space was set apart for a tiffin room.

Serving only tea coffee and snacks comes under the scope of a tiffin room. However by starting a tiffin room the difficulty of the staff in getting good, hygienic noon meals at a reasonable price did not get redressed. They had still to brave the rain or shine and drain their energy to go over to hotels for meals. Considering these difficulties meals also were to be served in the tiffin room at a price very low compared to the existing prices in hotels. Staff could, thus, enjoy good, tasty, hygienic food in quantity at a lower rate.

At headquarters the staff in the Craft and Gear Division at Cochin were the most hit in the matter of food. They did not have the service of a hotel anywhere nearby. The problem of lack of space to accommodate a tiffin room was worse than at Ernakulam. However, with great difficulty a room was set apart and a tiffin room with similar functions was started there in 1968.

To meet the initial expenditure towards organising the tiffin room the Departmental assistance in the form of interest free loan was utilised for the purchase of essential items like utensils, furniture etc. The loan was to be repaid in convenient monthly instalments and therefore, in the beginning particularly, the tiffin room was to be run with small profit to repay the instalments regularly and also to make up for the breakages, repairs etc. incurred in its running. It should be recorded with great satisfaction that with the active co-operation of the staff the tiffin

room could be maintained in high standards and that the loans could be repaid in time without default.

The tiffin room receives assistance from ICAR in the form of rent - free accommodation, free water and electricity and cash subsidy for fuel and salary of the staff. The tiffin room is managed by a committee consisting of elected representatives of the staff with the Director's nominee being its chairman. The elected members will hold office for one yeer. All the managing committees so far have strived their best for proper running of the tiffin room and in modernising it with all the necessary gadgets and equipments.

In the new building adequate and convenient provision has been made for running a full fledged Departmental canteen in place of the two tiffin rooms which function independently at Ernakulam and Cochin. Let us hope that this canteen will serve more useful purpose in the service of the staff particularly in the absence of any good public catering in proximity to the Institute at the Willingdon Island.

RECREATION CLUB

'All work and no play' will make anyone dull and dreary. A forum, therefore, is required where the staff, after a day's work, can engage themselves in recreational activities. The recreation club was formed with the objectives of providing facilities for social, cultural and recreational activities to the staff. In spite of poor finance and improper accommodation the club had been very active since its inception. Members of staff without any distinction whatsoever can enjoy all the privileges of the club.

The club maintains a small reading room provided with useful books, journals, magazines and daily newspapers. Most of these materials are generally donated to the club by its members in the best of spirits. Many of the interesting and illustrated literature have been obtained through the courtesy of the foreign Embassies in India. Besides, reading room facilities are provided for indoor games like carroms, chess and cards. Outdoor games occasionally played are badminton and football. Inspite of limited facilities a hand was laid even on gymnastic activities though for a short time.

Ceremonial occasions like the Republic day, Independence Day etc. are celebrated as gay functions where the staff with their family assemble and take part in the club activities. Club members are also occasionally taken out on specially arranged picnics to places of interest in and around Kerala. The club has also been organising get-together parties, farewell functions and felicitation meetings etc. on appropriate occasions.

One of the most important among the achievements of the club, perhaps, is bringing out the hidden histrionic talents of its members to the open. Their histrionic talents are put to best show at the Annual Drama Competition held by the Central Services Welfare Board every year. The most unique feature in the plays staged by the club in such functions is that unlike some other clubs taking part in these competitions, the C I F T Recreation Club has never had any occasion to hire outside talents as fillip to their troupe. Besides acting and directing, most of the plays so staged had even been written by the members of the club themselves.

Flag hoisting at the Institute on Independence Day

A farewel party to a retiring colleague, Shri Thomas Joseph, Administrative Officer

A Scene from the drama "Palichakal"

A Scene from the drama "Enikku Gusthi Patikkenta"

A Scene from the drama "Good morning Sir"

Sri. A. Gopalakrishnan Nair winner of fast walk. Unlucky in fancy dress

Fancy dress–first prize winner Smt. K. A. Devaky

CIFT team in women's tug - of - war

Laurels won by CIFT

The club has so far staged six dramas which have won acclaim from all. Of these 'SABDAM' besides being adjudged the second best play of the year produced the best comedian in Shri. P.Vijayan, the second best actor in late Shri. P. P. Antony and the second best actress in Smt. P. K. Vilasini. Baby Madhu, daughter of Smt. & Shri. Sadanandan came out as the best child artist. Smt. Alice M. Joseph was adjudged the best actress for her performance in 'NEETHIPEEDAM' staged by the club. Because of his versatile acting talents Shri. V. N. Rajasekharan Nair was unanimously selected to represent the Kerala zone dramatic troupe at the final drama competition in Delhi. In the entertainment field another laurel was won by Shri. A. Vasantha Shenoy who knocked away the 'FIRST' prize in the solo light music competition.

In the sports field too the club has made its impact. The club regularly takes part in the Central Services Regional Sports Meet held every year. No matter win or lose, the club participates in the true spirit of sportsmanship. The credit goes to the club whose members every year have bagged the trophies in tug-of-war, either as winners or runners up. Our women also have never been behind men in this item and they too regularly won the trophies in this field. In the event of FAST WALK for veterans over 45 years, Shri. A. Gopalakrishnan Nair has been a winner for three consecutive years every time pushing other competitors far behind him. It appears chances are scarce that he be beaten by any one in years to come except perhaps by shri. T. Neelakantan, a CIFT man, who is a close second. Incidentally, in his official duties Shri. Nair never walks ! He is our staff car driver. Kudos to Smt. Mary Thomas who besides winning the 'FIRST' prize in carroms singles annexed the 'doubles' title also in partnership with Smt. T. T. Annamma. Smt. K. A. Devaky in a much impressive outfit and makeup, won the 'FIRST' prize in Fancy Dress Competition.

Many names have found place in the list of successful competitors, but many more are there who by guiding, encouraging and sweating from behind the screen have contributed for the achievements. Much and more of the hidden talents are yet to surface which, let us hope, will materialise in years to come and when the club activities are more intensified.

As we move into the new building the club also will have better status when expanded activities in different fields can be thought of. Cricket, football, hockey, tennis, basket ball, volley ball, badminton, table-tennis, swimming etc. are some of the sports and games which can be considered. The club can take up some important social activities too. All these and much more will be possible only with everybody's co-operation and good will. Let us look forward for liberal grants in cash and kind from ICAR. In return let us resolve and solemnly assure that it will never be 'All play and no work'.

Let us all work hard, this is no time for sleep-

Vivekananda

THE C. I. F. T. AND THE FISHERY INDUSTRY

R. MADHAVAN NAYAR*

To help the development of the Fishery Industry the Central Institute of Fisheries Technology was established in 1957. The Institute was designed to conduct research and development work with a view to increase fish production by evolving suitable designs of craft and gear, by standardising procedures for the storage, transportation and preservation of fish, by utilising waste products and by helping import substitution. The Institute was also enjoined to disseminate and popularise the findings of research among the people involved in the Fisheries Industry.

From small beginnings the Institute has grown in the course of time into a large organisation with several sub-stations and units all over the country and employing hundreds of scientific, technical and administrative personnel and with several specialised divisions and departments. It has some significant achievements to its credit.

In the first place it has identified certain outstanding problems facing the Fisheries Industry, and has devoted considerable time and research to find solutions for those problems. It is certainly to the credit of the Scientists of the Institute that they have been able to achieve substantial results

It is only in the last few years that the importance of the mechanisation of shrimp fishing was recognised. Many interested persons who had entered the field were groping for suitable vessels to be employed for off-shore fishing operations. The Scientists of the CIFT soon came forth with several designs for fishing vessels taking into consideration the condition of our coastal waters and the broad objectives of the fishermen. The fact that over 5000 fishing vessels have been built and deployed for fishing all along the coasts of India is ample testimony to the success of the designs developed by the Institute.

Teak, as is well known, was the wood traditionally used to build sea-going vessels. This was very expensive, and after considerable research, the CIFT was able to introduce the use of Venteak as an admirable substitute for the costly teak. Venteak has stood the test of years, and has greatly reduced the cost ot fishing vessels and therefore of fishing itself.

The efforts of the C. I. F. T. have resulted in eliminating the expensive copper sheets for sheathing wooden craft and substituting therefore aluminium alloys and fibre-glass reinforced plastics.

*Shri. R. Madhavan Nayar, a pioneer in fish processing industry, was a member of the Achievement Audit Committee of CIFT. Ed.

Similarly the introduction of a new anti-fouling paint after eliminating imported components has proved a success. This should result in the saving of foreign exchange and in reducing the cost of paint applications.

In the sphere of fishing technology, the C.I.F.T. has standardised trawl nets and otter-boards for trawlers. They have also developed quality specifications for various gear and tackle, improved designs for gill nets, electrical and electronic testing and measuring instruments etc.

The development of cheap containers for the transport of iced fish has given a fillip to the movement of catches from the coastal areas to the factories and markets in the interior. In the field of processing technology, freezing and preservation methods for fish and shellfish have been standardised, and hygienic means to improve the technological quality of certain processed fishery items have been formulated.

The C. I. F. T. has claimed that certain measures recommended by them will prevent drip-loss in frozen prawns, and these if accepted and put into practice by the industry should be considered to be a great step forward in freezing technology.

The other contributions by the C. I. F. T. to yield scientifically acceptable products are methods to anaesthetise live frogs before cutting them, the prevention of discolouration and moisture loss in frozen fish, prevention of cut-end blackening in canned prawns the introduction of standards of canning as well as for the dehydration of various fishery products, the development of the methods for the preparation of quality fish protein concentrate, of high grade bacteriological peptone, fish flakes, fish soup powder and instant protein food from trash fish.

It is learnt that work is under way for producing shrimp extract, breaded shrimp steaks and fish paste.

There can be no doubt that the working of the C. I. F. T. over the last several years has encouraged mechanised fishing and has resulted in certain benefits to the fishery industry. The various techniques devoloped by the Institute are well worth commercial exploitation by the Industry, and it is to be hoped that entrepreneurs will realise the importance of diversification and accept the findings and recommendations of the C. I. F. T. and take measures to manufacture new products both for internal consumption and sale abroad.

With the laboratory and research facilities at their disposal, the C. I. F. T. is well equipped for finding answers for the numerous small problems of fisheries. These are problems which arise from day to day and which are peculiar to the localities involved. Though the solutions found for them may not be spectacular in nature, nevertheless they will be of immense value for this developing industry.

It is also to be examined whether the extension work of the Institute cannot be expanded. The Institute should ascertain whether the results of their research have been properly disseminated and propagated, and whether they have reached all sectors of the trade and business community, especially those sections which can be expected to make use of such knowledge. It was not the Government's intention that the Institute should conduct pure research, research for the sake of research; on the other

hand, the intention was to do research with particular objectives, and those objectives are simply to develop the fishing and processing industry. The necessity has to be recognised for regular meeting of the Officers of the Institute and the members of the industry so that the problems and outstanding issues can be discussed and an effort made to identify those which have to be pursued by the Institute. This will mean not only the development of an active liaison between the Institute and the Industry but will also ensure the much-needed mutual participation and involvement in one another's endeavours.

Modern world is a world of science and we cannot progress without science -

Nehru

India must remain India if she is to fulfil her destiny -

Aurobindo.

"A nation's strength ultimately consists in what it can do on its own and not in what it can borrow from others."

Indira Gandhi.

The Personnel Manager in a big organisation keeps a bowl of gold fish on his desk. No, he isn't particularly interested in fish culture he explained to a friend. "It's just that it's nice to have something around here that opens its mouth without asking for a rise".

Notice in the window of a new fish shop: "We sell anything that swims". A customer walked in and demanded Esther Williams.

Some people were talking about various objects found in fish. "Eh chaps. I'll tell you about an interesting experience I once had" said one of them. "I fell in love with a beautiful girl and in time proposed her and she accepted me. Soon after that I was sent out of town for a few months on business. Before returning I bought my fiance a beautiful diamond ring as a surprise. However, it turned out the surprise was on me. During the train trip back I was reading a newspaper and what did I see but an item announcing the marriage of my girl to another man I was so angry that when the train was crossing a bridge, I opened the box and threw the ring into the river. A few months later I was in a restaurant and ordered a portion of fish. I took a bite and felt something hard, "Guess what it was?" "The diamond" Shouted the listeners. "No, it was a fish bone" Said the ex-fiance.

A parishner who was often out fishing than in Church on Sunday, appeared on Monday morning and presented the minister with fine string of pickerel, saying; "Those fish were caught yesterday and may be your conscience won't let you eat them".

"Don't worry about that" replied the minister, "I am sure the pickerel were not to be blamed",

They were looking upto the depths of the Grand Canyon. "Do you know" asked the guide "that it took millions and millions of years for this great abyss to be carved out?"

"Well, well" exclaimed one traveller "I didn't know this was a government job".

Overheard on the beach on a coast resort. Small boy to mother "Mummy may I go to swim?"

"Certainly not, my dear" replied the mother "it's far too deep"

"But Daddy is swimming" wailed the boy.

"Yes, dear, but he's insured"

Son: "How do fishermen make those nets, Dad?"

Dad: Oh they just take a handful of holes and sew them"

Customer : "I can't eat such a rotten fish. Call the proprietor"

Waiter : "It's no use, Sir, he won't eat it either".

The little old lady was taking her first ocean voyage. A huge whale was sighted and as the ship's passengers crowed the rails, sure enough, the whale spouted terrifically. She gasped.

"It could at least quit laying on its back and showing off like this" she fumed as she sped towards her state room.

Do you know how to tell a little girl sardine from a little boy sardine ?"

"No" was the reply.

"Look and see which can they come out of".

First fisherman : I hear you went out fishing with your girl friend last week

Second fisherman : Yes, that's right.
F. F. : Catch anything ?
S. F. : Don't know yet.

He acquired a sudden ambition to raise electric eels and accordingly went out and bought a big, fat, sassy male member of the species. Then after intensive search, he found a female eel.

He put them both in a bowl and waited, But nothing happened. Eventually he lost patience.

"Look here, you eels" he snarled "I paid big money for you two and I gave you a nice home to live and the finest food, but I've still got just two eels. What's the matter ?" "Well, Sir" explained the male eel "It is like this, I am A. C. and she's D. C."

The Biology Professor had just finished his lecture on how a fish breeds.

One lady student asked 'You mean, Sir, Pappa fish and Mamma fish do nothing ?"

"That's right" replied the Professor, "They just throw their elements into water and mixing up of these two takes place accidentally. That is why the famous English expression : "O poor fish"

THEY WERE HONOURED

During the course of the short span of useful existence of the Institute occasions had been many when its scientists won national recognitions for their inventions/developments in their field of work.

Independence Day Award (1970) to Shri. T. S. Gopalakrishna Iyer

Shri. T. S. Gopalakrishna Iyer was the first scientist from CIFT to be honoured by the Invention Promotion Board for developing a 'humane method of cutting legs from live frogs'.

Only the hind legs of frogs are used for freezing and export. The practice prevailing in the industry since then was to sever the hind legs from live frogs leaving the carcass to jump out and struggle hard till death. This surely is an awful sight and it became necessary to develop an easy method to narcotise the live animals and then to cut off the legs thus subjecting them to minimum suffering. The method developed by Shri. Iyer consists in dipping the live frogs in a 10% solution of common salt for 10 minutes when they get paralysed and subsequent cutting of the hind legs. The process is simple, the animal suffers less and also improves the bacteriological qualities of the product.

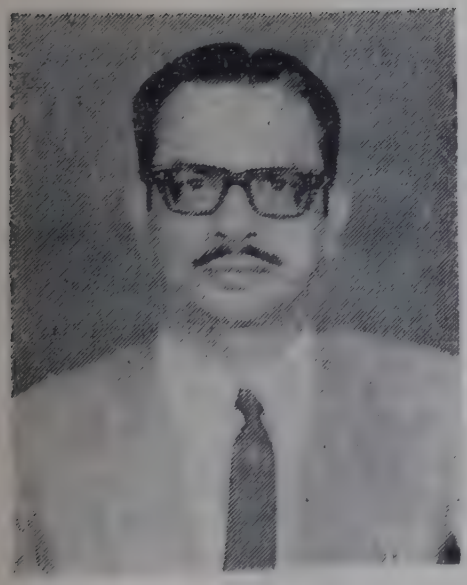
Shri. Iyer was awarded Rs. 500/- for the development of this method.

Republic Day Award (1971) to Shri. T. K. Sivadas

Shri. T. K. Sivadas won an award of Rs. 1000/- from the Invention Promotion Board for the invention of an improved operational depth measuring instrument for fishing gears like trawl nets and gill nets.

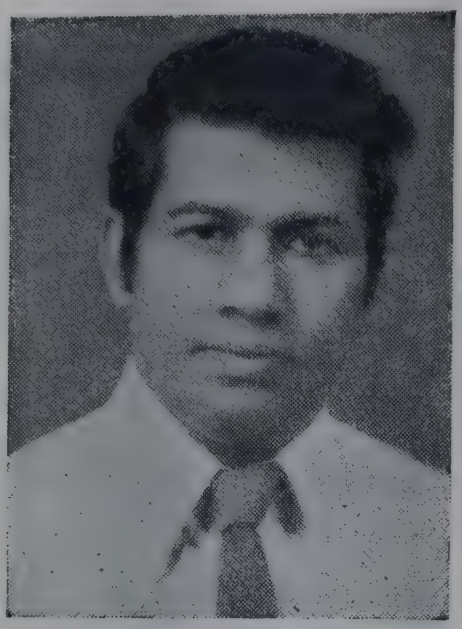
The modern fishing operations are aided by a number of sophisticated electronic instruments for locating the fish populations and efficiently catching them. Even having located the fish population in the sea it is important to know whether the gear is operated at appropriate depths for its complete exploitation. The instrument developed by Shri. Sivadas gives correct information on the depth at which the gear is operating and thus can be profitably made use of for efficient fishing.

Independence Day Award (1973) to Shri. A. P. Valsan



With the development of modern fish processing industries like freezing and canning which utilises mainly prawns, the traditional fish curing industry became progressively neglected. However curing is still popularly practised in the rural fishing villages for preservation of their catch of fish and plays an important role in the rural economy. Major defects observed with cured fish are their unattractive appearance and low shelf life. Shri. Valsan developed a new simple and effective method for the preservation of cured fish products which consists in sprinkling refined salt containing 3% sodium propionate on the cured product in the ratio 1:10 by weight. Application of this preservative keeps cured fish in good condition for over 9 months compared to 1-2 months normal life.

Shri. Valsan was awarded Rs. 1000/- for his discovery as a part of the Independence Day Awards to Indian inventors



Republic Day Award (1974) to Shri. M. Velu.

Shri. M. Velu received a cash award of Rs. 1500/- from the National Research Development Corporation of India for his invention of an equipment for eradication of aquatic weeds from inland water bodies.

The machine, first of its kind to be developed in India is suitable for operation in large water bodies for clearing both submerged and floating aquatic weeds. It consists of a shallow draft self propelled barge on which the machinery is fitted for uprooting or picking up the submerged and floating weeds respectively. The machine has been made out of completely indigenous materials,

The US Department of Fisheries in the State of Washington tags salmon tn order to learn more about their migratory habits. It pays three dollars for the return of each tag with information as to where it was found. Alan Yanofsky of New York City dutifully returned a tag with this explanatory note:

"Enclosed is a tag that came off a salmon. I fouud it when I bit into my sandwich. It came to me in a tin of salmon. Please send three dollars".

WE BID YOU A HAPPY

RETIRED LIFE

Shri. Thomas Joseph, the first Administrative Officer and the only person who retired from service. (16-10-1972)

Congratulations to CIFT on this auspicious occasion of inauguration of their permanent building

from

SOCIETY OF FISHERIES TECHNOLOGISTS (INDIA)

Consequent to the shifting of the Headquarters of CIFT to the new premises the address of the society will be

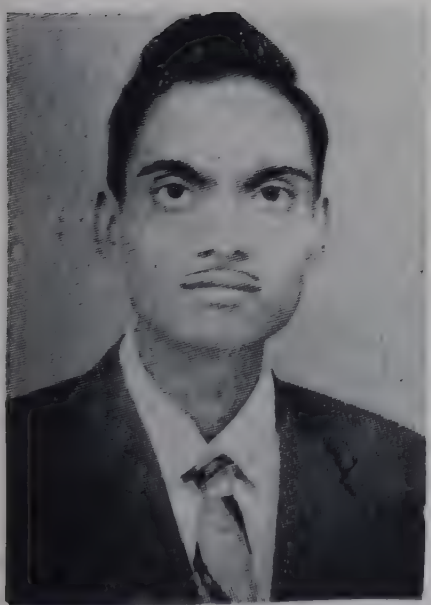
C/o CIFT
WILLINGDON ISLAND, COCHIN-682 003

The editorial office of the journal "Fishery Technology" will also be at the above address.

THEY LEFT US FOR THE HEAVENLY ABODE

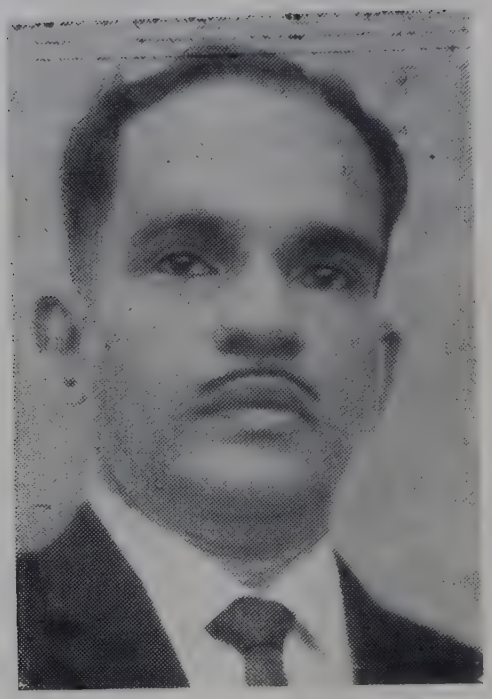
Joseph Dominic
Carpenter - 27-7-1964

Vasippalli Das
Tindal - 24-9-1967



R. V. V. Satyanarayana Rao
Research Assistant
9-2-1969

P. P. Antony
Tindal - 11-8-1972



Dr. V. K. Pillai
Director - 5-12-1972

T. C. Karthiayani
Assistant Fishery Scientist
19-3-1973

P N. R. Nair
Projector Operator
21 3-1975

A resume of the significant achievements of the Institute has been given elsewhere in this souvenir. The following pages give brief accounts of the details of certain processes/programmes developed by the Institute which are either already adopted by the industry or can be adopted by it advantageously.

Prevention of thawing and cooking losses from prawns

Loss in weight due to thawing of raw frozen prawn meat is on the average 10% and that due to cooking is 45%. Both these losses are disadvantageous to the processor as well as the consumer for reasons of economy and quality. The processor has to use extra quantities of raw material to compensate for the losses and the consumer gets a product less rich in flavour. Methods developed to minimise thawing and cooking losses are as below:

A. Prevention of thawing losses.

1. Drain the properly washed prawn meat (raw) on perforated and slanting table tops for at least 10 minutes.

2. Weigh the required quantity of the prawn meat (2.27 kg. or 2.00 kg. as the case may be) in clean basins.

3. Pour 90 ml. (per kg. of prawn meat) of a 16% solution of a mixture of sodium tripolyphosphate and potassium dihydrogen phosphate in the ratio of 3:1 by weight and mix the prawns with the solution by hand.

4. Transfer the prawns to polythene lined freezing trays or cartons.

5. Freeze without further glazing and store.

Advantages:

(i) Complete prevention of thawing losses resulting in atleast 10% saving of raw material.

(ii) Size grade remains unchanged.

(iii) Better appearance and flavour.

(iv) Low cost of treatment compared to the gains.

B. Prevention of cooking losses.

1, Add to the phosphate solution, 16% common salt and dissolve it by stirring.

2. Mix the prawn meat with the solution (90 ml. solution/ kg. prawn meat).

3. Cook in 5% brine for 45 seconds.

4. Cool in ice and water, drain and pack with 10% excess weight.

Advantages:

(i) Cooked yield is 85-90% compared to 55-60% for untreated.

(ii) Size grade remains almost constant.

(iii) Better appearance and flavour.

(iv) Low cost of treatment.

NOTE:

G. I, utensils and freezer plates may get corroded due to constant contact with the phosphate solution. Hence utensils made of Aluminium, stainless steel or polythene are recommended. Freezer plates shall not be aliowed to remain at room temperature with the solution spilt on them.

Manufacture of bacteriologically sound frozen frog legs

Frozen frog legs are exported to U. S. A., France and other European countries. Sice frogs live in dirty environments, the surface of their skin and intestinal tracts contain faecal streptococci and salmonella. Human handling may further add coagulase positive staphylococci. Strict microbiological requirements are laid down for frozen frog legs both by our country and by the buyers. Hence it is essential to produce frozen frog legs conforming to these requirements to keep up the industry. The following processing method, when strictly adhered to, can produce excellent quality product.

1. Processing of frog legs shall be carried out only in cutting centres approved by the appropriate authority.

2. Only live frogs shall be used.

3. The live frogs shall be washed once in good quality water containing 200ppm. available chlorine to remove adhering dirt etc.

4. The washed frogs shall be dipped in 10% common salt solution for 10 minutes to paralyse them.

5. The hind legs shall be severed from the trunk at the waist taking care that the intestine is not broken. As the intestine usually contains high numbers of faecal and pathogenic bacteria, it may contaminate the flesh if broken.

6. The severed legs shall be kept in 5% common salt solution containing 200ppm. available chlorine for proper bleeding. The brine used for bleeding shall be replaced at reasonably frequent intervals.

7. Pieces of intestine, if left on the severed pair of legs, shall be removed. These legs are washed in water containing 200 ppm. available chlorine and stored in ice for transportation to the freezing plant.

8. Material from 7 above is dipped for 15 minutes in 5% common salt solution containing 500 ppm. available chlorine.

9. The legs are skinned and trimmed removing the cloaca and the saddle, fingers, loose hanging meat, the veins etc.

10. Each pair of leg is carefully washed three times in water containing 200 ppm. available chlorine. Special care may be given for washing the cloacal region.

11. The washed legs are immersed in good quality water containing 200 ppm. available chlorine for 10 minutes with occasional stirring of the material. The volume of water shall be three times that of the material.

12. These legs are washed in potable water containing 5 ppm. available chlorine till free from excessive chlorine smell.

13. They are wrapped individually in polythene paper (previously dipped in 200 ppm. chlorine) and secured with rubber bands.

14. The wrapped legs are frozen and stored.

Strict observance of good hygienic and sanitary practices in the cutting and processing areas is also essential.

Prevention of blackening in canned prawns

Blackening of prawns canned in brine and that of the can interior are quality defects encountered both in marine and backwater species. These defects, though not injurious to health, are not permitted in the product for aesthetic reasons. Copper and iron naturally present in the raw prawns and small quantities of these elements getting added up as contaminants during processing result in the formation of copper and iron sulphides during the retorting operation. Blackening of the product and the can interior can be prevented by methods given below.

A. IN MARINE PRAWNS

1. Avoid contamination of the raw material and ingredients with copper and iron from water, ice, utensils etc.

2. Adjust the titrable acidity of the fill brine in such a way that after canning the level is 0.06% or above, expressed as anhydrous citric acid w/v. Use 0.2% citric acid in the blanching brine and 0.1 to 0.45% citric acid in the filling brine, depending on the ice storage period of the raw material. Raw material stored in ice for more time requires more quantity of citric acid in the filling brine.

B. IN BACK WATER PRAWNS

Mere adjustment of titrable acidity does not prevent cut-end blackening in backwater prawns *(puzhanaran, choodan and thelly)* canned in brine. In these cases addition of 50 mg.% of disodium EDTA in the filling brine (3% sodium chloride + 0.1% citric acid) completely prevents blackening and improves the colour. Commercial scale application of the additive has established cent percent reproducibility of the results. Storage, upto an year, of the product showed no adverse effects attributable to the additive. The additive is a permitted one and the cost is negligible.

Hints on maintenance of bacteriological quality of canned prawns

The most important criterion for judging the suitability of canned foods for storage and human consumption is its freedom from micro-organisms capable of producing spoilage, toxins and diseases in man. Occasionally at least, every canner experiences a case of a rejectable product being turned out - the defect being lack of cammercial sterility. Hence it is essential that the processors are aware of the probable sources of micro-biological defects in canned products.

1. Empty cans should be stored in such a manner that no contamination takes place from dirt or any other extraneous material.

2. At the time of use the cans may be checked for constructional defects, defect in lacquering etc. Defective cans should not be used for packing the product. Defects, if any, may be brought to the notice of the manufacturer for rectification.

3. Before filling with the blanched prawn, the cans should be washed properly with water.

4. The meat should be cooled immediately after blanching by circulating cold air and the cooled meat should be canned immediately.

5 Temperature and pressure of retorting (processing) should be recorded on a log book and during retorting the vent pipes of the retort should be kept slightly open. Coming up time and release time should be more or less constant. Care should be taken to give proper time and temperature for sterilization.

6. The processed cans should be immediately cooled in chlorinated running water in which the free chlorine level shall not be less than 3 ppm.

7. For adjustment of seam, seaming machine may be tested as frequently as possible. At least I in 200 cans may be sealed empty for testing, both by applying pressure and by actual seam measurements.

8. Utensils comming in contact with raw and blanched meat should be washed initially with a detergent like 'Teepol' solution of 0.5% concentration, followed by a disinfectant like chlorinated water containing 100 ppm. of available chlorine. Ice used with the material should be prepared from potable water. Overhead and storage tanks should be kept well covered and should be cleaned at least twice a week.

Cooked frozen prawns - hints on maintenance of bacteriological quality

India has a large volume of trade in cooked frozen prawns especially with U. S. A. and Australia; in peeled, deveined, cooked and frozen forms to the former and in the cooked and peeled form to latter. Strict bacteriological quality standards for these products are laid down in the importing countries. In order to sustain the present market and increase it further it is essential to give due care in processing so that the products conform to the standards specified.

Investigations have shown that contamination of the material with faecal organisms result from unhygienic handling practice and use of bad quality water and ice and unclean utensils. Workers' hygiene is the main factor which influences contamination with coagulase positive staphylococci. Material gets generally contaminated with Staphylococci when the workers' hands are not washed asceptically before start of the work since the organisms are inhabitants of wounds, ulcers, mucus etc.

To prevent contamination from the above sources and to prepare good quality products certain minimum precautions have to be taken in the processing factories. These are mentioned below:

1. The workers should be instructed to maintain proper cleanliness always. Before starting the work they should clean their hands using a detergent (soap) and should then disinfect the hands by using chlorinated water (chlorine at 200ppm. level). Workers suffering from communicable diseases, ulcers, wounds, skin eruptions etc. should not be allowed to handle the prawn at any stage.

2. The various utensils used for handling the material will be sources of bacterial contamination unless they are cleaned and disinfected before use. All the materials should be washed first with a detergent (0.5% 'Teepol' solution) and then, for disinfection, they should be kept immersed in water chlorinated at 100ppm. level for 4-5 minutes. They should be finally washed with fresh water. When prawns and froglegs are handled in the factory at the same time, separate utensils should be used for each of the items.

3. The ice used should be prepared from chlorinated water and it should be handled carefully and hygienically since material coming in contact with contaminated ice will pick up bacteria from it.

4. After cooking the raw material it is cooled in ice cold water. If the water used is of poor bacteriological quality, as is found sometimes, it will be a source of heavy contamination of the material. The cooked material should be cooled only in water chlorinated at the level of 10 ppm. so that contamination from this source can be completely checked.

5. Before packing the peeled and washed material into the freezing trays, it should be dipped in water chlorinated at 20 ppm. level for 10 minutes. This will effect in considerable reduction of bacterial load in the material.

6. As a general rule, the time interval between cooking, peeling and admitting the material into the freezer should be kept minimum, that is, should be processed within the shortest possible time so that bacterial multiplication during storage can be kept to the minimum.

7. The water used for glazing and reglazing should be chlorinated at the level of 10 ppm. and 50 ppm. respectively and the reglazing water should be changed after dipping at the most about 16 blocks in the same water. When more blocks are dipped in the same water it becomes more polluted and the bacterial load becomes high.

8. The packing of the frozen material should also be done carefully under strict hygienic conditions. If gloves are used they should be washed thoroughly and properly disinfected.

Products processed even from the freshest raw material will be of substandard bacteriological quality if utmost care is not exercised during handling and processing of the material.

Factory sanitation

Maintenance of a high standard of cleanliness is quite essential in any food processing plant. Food material processed from even the freshest raw material can turn out to be of unacceptable quality or even dangerous to human life if it is handled and processed under unhygienic conditions. This is especially so in the case of fish products as fish is known to be one of the most perishable of food materials.

The main sources of bacterial contamination

In fish processing plants bacterial contamination of the material occurs from the surfaces of tables and various utensils with which the material comes into contact, from the water used for various purposes like washing the material, glazing and reglazing of the frozen product etc. and also from the ice used for preservation of the material. It is further observed that in almost all cases of contamination of the material by faecal organisms like Escherichia coli, Entero cocci etc. the source is mainly water and/or ice. In order to maintain a satisfactory hygienic standard it is essential that all the utensils and tables etc. that come in contact with the material are kept always clean so that the bacterial load on the surfaces is kept below 1000 organisms per square inch. The water and ice, must not contain bacterial loads of more than 100 organisms/ml. Insufficient cleaning of overhead storage tanks, storing water in open tubs in processing halls and using it carelessly and careless handling of glazing water are the main reasons for contamination of water. Ice gets contaminated when water of low bacterial quality is used for preparing the ice, when it comes in contact with unclean surfaces, for example, where the ice cans are dipped in thawing tanks containing impure water, when stored on or dragged along dirty floors etc. The water used in the processing plant should be potable. It should be chlorinated to contain 5 ppm. of residual chlorine. The ice used should be that prepared from potable water. Utmost care should be exercised in handling it under hygienic conditions. If by some means the ice gets contaminated it should be washed with chlorinated water (Chlorine at the level of 5-10 ppm.) before using with the fish.

An adequate cleaning programme is essential

An adequate cleaning programme is the first requisite in maintaining good sanitary condition in the fish processing plant. The cleaning work carried out should be effective in (1) the removal of visible product wastes, foreign matter and slime (the presence of slime can be felt by dragging the finger over the surface - if the surface is slippery it contains slime.) (2) the destruction of spoilage bacteria and bacteria that reflect upon general sanitation (3) the removal of undesirable chemicals such as those used as detergents or germicides. In removing slime, dirt or deposits a detergent is necessary. High pressure water is effective in some cases. Tenacious deposits are removed sometimes only by use of scrapers. For destroying the bacteria a germicide is to be used. The detergent and germicide are to be used only at correct levels required.

The cleaning schedule for fish processing factories and primary processing centres

1. Rub the surface with brush so as to remove all solid organic matter.
2. Apply a suitable detergent ('Teepol'- 0.5%) to remove slime, followed by washing with fresh water (chlorinated at 10 ppm. level).
3. Apply a suitable disinfectant, (sodium hypochlorite or bleach liquor solution) containing 100 ppm. of available chlorine for 4 minutes. (Rubbing with a brush or coir gives better results). For disinfecting floor surfaces, gutters etc. the chlorine dose should be 500-800 ppm.
4. Finally wash throughly with fresh water (chlorinated at 10 ppm. level).

Do the cleaning work after each shift of work

The above schedule of cleaning is suitable for cleaning the various utensils, table surface etc. The utensils, tables, floor surface, gutters etc. should be cleaned as per the schedule *after each shift of work*. Before the start of the next shift they should be washed well again with water chlorinated at 5 ppm. level.

Cleaning of boat decks, fish holds, wooden boxes etc.

It has been observed that the quality of the freshly landed fish depends to a great extent on the care with which it is handled and stored in the fishing vessel. Apart from the use of ice, the hygienic condition of the fish hold and fish containers is the important factor which determines the quality of the landed fish. It is therefore, essential that the boat deck, fish hold, the containers for fish etc. should be thoroughly cleaned daily before going for fishing. The cleaning schedule recommended for boat decks, fish hold and the fish containers is as below:

1. Rub the surface with brush so as to remove all solid organic matter.
2. Apply a suitable detergent (Teepol - 0.5% solution) to remove slime, followed by washing with fresh water.
3. Apply a suitable disinfectant (Sodium hypochlorite or bleach liquor solution) containing 1000 ppm. of available chlorine for 4-5 minutes.

4. Finally wash thoroughly with fresh water.

By cleaning the surfaces as per the schedule the load of spoilage organisms can be reduced and kept within limit and also complete reduction in the pathogenic organisms can be achieved.

Deodourisation of fish containers, fish carrier vans and refrigerated wagons

Removal of fishy odours from the fish carrier boxes, vehicles and rail wagons has been an/all important problem faced in the transport of fish. It has been observed that by proper cleaning the fishy odour can be completely removed. The schedule of cleaning worked out by this Institute in this respect is as below:

1. Preliminary washing and scrubbing with 0.5% soap solution to remove all adhering slime.

2. Spraying with 100 ppm. available chlorine solution to remove the fishy smell followed by washing with water.

3. Spraying with 50-60 ppm. sodium thiosulphate solution to remove the residual chlorine smell.

4. Final washing with fresh water.

How to chlorinate water with bleach liquor to the correct chlorine levels.

A chart showing the quantities of bleach liquor of different concentrations required for chlorinating known volumes of water at the desired chlorine level has been prepared. The following data would be useful as a basis for calculation:

For 10 litres of water

Chlorine level (ppm.)	Bleaching powder of 30% available chlorine to be used (g.)	Bleach liquor containing 10% available chlorine to be used (ml.)
1	0.03334	0.1
5	0.1667	0.5
10	0.3334	1.0
50	1.667	5.0
100	3.334	10.0
1000	33.34	100 00

'Teepol' solution

0.5% solution of Teepol is to be used as the detergent in the cleaning schedules recommended. 5 ml. of Teepol added to one litre of water will give one litre of the solution of the required concentration and on this basis the quantity of Teepol for known volumes of water can easily be calculated.

Insulated container for long distance transportation of fish

Fish catch in India shows a regular upward trend consequent on the rapid mechanisation of fishing crafts. It is estimated that about 65% of the total landings is marketed in fresh condition and part of it goes waste.

An efficient and economic method of utilization of this fish is to transport them to internal markets. But most of our potential internal markets are thousands of kilometres away from fish landing centres and fish should reach them in an unspoiled condition.

One of the most effective and commercially tried means to retard spoilage of fish is to reduce its temperature. Crushed ice is usually employed for this purpose and fresh fish keeps well for limited lengths of time in contact with it. But in a tropical country like ours ice melts rapidly necessitating reicing at frequent intervals during transport to distant places to maintain the fish at sufficiently low temperature. The use of more ice will increase the cost of fish at the consumers' end. Well insulated containers which can retard the rapid melting of ice, therefore, are essential. CIFT has developed an insulated container which can be used for transport of fish (iced and frozen) to long distances. Details of the container and the process to be adopted are as follows:

Container

Wooden boxes made of 3 ply plywood sheets nailed to 2 cm. thick wooden frames (ordinary tea chests) can be used as the container. Such boxes are fairly robust and stand the transport well. A box of the size 48 cm. x 48 cm. x 6 2cm. will hold approximately 100 kg. ice and fish. 20 mm. or 25 mm. thick thermocole slabs cut to the inside size of the box and sealed in polythene bags (200 gauge) to prevent the thermocole slabs from coming in contact with the ice melt water are used as insulant in the box. Six thermocole slabs are required to insulate the complete box, four in all the four sides, one at the bottom side and one inside the lid.

Transport of iced fish

1. Fish and ice should be in the ratio 1:1
2. Put a layer of crushed ice at the bottom of the box.
3. Place one layer of fish and then another layer of ice and so on, with a layer of ice at the top finally.

4. Fix up the lid to the box properly, wrap the entire box in gunny and sew.

By this method the fish maintains its freshness for 55-60 hrs. Fish is now regularly being sent from Veraval to Bombay and Delhi and from Kakinada to Calcutta adopting the above process. Cost of one box of the size 48 cm. x 48 cm. x 62 cm. insulated in the above manner works out to nearly Rs. 30/-. Even if the boxes get damaged in transit due to rough handling, the thermocole sheets are fairly safe and can be re-used. If proper care is taken in handling it can easily last for two or three seasons.

Transport of frozen fish

Since reicing enroute is not generally practicable due to various reasons and maximum period of storage of fish in insulated container is limited to 2½ days and since prolonged storage of fish in ice adversely affects its quality it became necessary to evolve a suitable method for transportation of fish to long distances. The best alternative has been found to be packing frozen fish instead of iced fish in the insulated container

Method

1. Freeze the fish, either individually or as blocks, to a temperature of 20°C. (Small fish like sardine, mackerel etc. should be frozen as glazed blocks. Big fish like seer, tuna etc. can be frozen individually or as small pieces)
2. Pack the frozen fish in the thermocole insulated plywood boxes of convenient size.
3 If individually frozen fish is packed, fill up gaps between fish with crushed ice.
4. Fix up the lid and transport in ordinary rail wagons or trucks.

By this method fish can be transported to very distant places as may require 3-4 days' journey. Fish will reach the desitination in a partially thawed condition and can be marketed as fresh fish.

An insulated container of the size 48 cm. x 48 cm. x 62 cm. can hold about 60-65 kg. of fish frozen as glazed blocks (eg. sardine). This method is now being employed for transport of fish from Veraval to Bombay and Delhi, and from Kakinada to Delhi and Calcutta.

Smoking of eel fillets

Considerable quantities of marine eel are landed in India every year. The fishery is important mainly in the State of Maharashtra. Even though a good fish, in fresh form eel does not find good market, mainly because it is brought in large quantities alongwith better quality fish. The Central Institute of Fisheries Technology has been carrying out investigations to develop method for effective preservation and processing of this fish and showed that eel cold be converted into an excellent smoked product. There seems to have good scope in developing internal as well as export market for the smoked product.

1. *Material:* As far as possible use only fresh raw material for smoking. If there is any time lag before processing keep the fish in sufficient quantity of ice.

2. *Cleaning and filleting:* Rub the surface of the fish with coarse salt to remove all the slime and wash thoroughly. Remove the head, viscera and other waste parts and make into fillets of size about 2.5 cm. x 15 cm. x 2.5 cm.

3. *Brining:* Wash the fillets thoroughly. Immerse the pieces in 15% brine for 30 mins. Take out and drain.

4. *Smoking·* Dry the fillets for about half an hour first for a superficial drying. Hang the pieces suitably on bars in the smoke-kiln. Carry out smoking for 12 to 15 hours at a temperature of about 45-50°C. Use a mixture of coconut husk and saw dust in equal quantities as the source of smoke. A suitable smoke-kiln has been developed by the Institute for smoking fish on laboratory scale.

5. *Final drying:* Dry the smoked product again to bring down the moisture content to about 35%. The dried product. after cutting the sides, can be packed in polythene bags in convenient weights. Store the product in cool dry place.

The smoked eel fillets thus prepared have got a reddish yellow colour, appealing odour and good taste. The yield is about 25%.

Laminated Bombay duck

Of the total marine fish landings in India, about 10% is constituted by Bombay duck *(Harpodon nehereus)* popularly known as 'Bombil'. Landings of the fish during the past five years have been as below:

Landings of Bombay duck in India

Year	Landings (m. tons)
1970	78,443
1971	71,415
1972	51,496
1973	44,394
1974	76,433

Large quantities of the fish are landed in the states of Gujarat and of the total catch of the fish about 90% is constituted by the catch in these two States. The fish is also taken in appreciable quantities on the Andhra and Orissa coasts and the estuaries of Bengal

At present the fish is mostly sun-dried by the traditional method. A portion of the sun-dried product is exported to countries like Mauritius, Ceylon, Burma, Singapore and the rest is marketed internally. A small portion of the catch is now converted into dried laminated Bombay duck which has got a good market in countries like United Kingdom. There is every possibitity of expanding the trade in dried laminated Bombay duck in view of the demand for the product abroad. As in the case of any other product, quality will be the deciding factor in sustaining and expanding the market for the product. To get top quality product it is essential to adopt standard method for processing.

Process

1. Use only fresh Bombay duck. If there is any time lag before processing, keep the fish at ice temperature during the period.

2. Wash the fish thoroughly. Remove the guts and wash thoroughly again. Suspend the gutted fish from a scaffold for surface drying (for about 2 hours). At this stage, remove the head, tail and fins using a sharp knife or scissors and split the fish longitudinally on the belly portion.

3. Dip the fish thus laminated in sufficient quantity of 1% brine (prepared from refined salt) for 20 minutes.

4. Drain the fish and spread on galvanised iron wire mesh trays (on a platform) or in any other suitable manner and dry to a moisture level of about 16-17%.

5. Flatten the dried product by means of a roller press. Trim the sides to get pieces of uniform size.

6. Dry the product again for 1-2 hours so that the final moisture content would be about 14%.

7. Make the finished product into lots of 25 or 50 numbers and pack in polythene bags. Store properly under hygienic conditions.

In the commercial method followed at present, it is particularly observed that the bone is removed from the fish just after splitting the semidried fish. Actually, the bone, which is very delicate and cannot be made out easily after pressing the dried fish, need not be removed so that a very time consuming step in the method can be avoided.

Incorporation of BHT (Butylated Hydroxy Toluene) and NDGA (Nor dihydro guaiaretic acid) in dipping brine upto a concentration of 0.1% effectively controls the development of discolouration (yellowish brown) and consequent spoilage of the stored material.

It is always advantageous to use a tunnel dryer for drying the product in view of quality of the finished product. In sun drying, the fish is exposed to contamination from dirt, sand, flies and insects which results in sub-standard quality and early spoilage of the product. Moreover, by sun drying, it is difficult to get product of uniform quality with the desired moisture content. A tunnel dryer of 1 ton (raw material) capacity for production of laminated Bombay duck has been designed by the Institute.

An effective method of preservation of cured fish products

Cured fish is a traditional product of export from India. Various types of products like 'light cured', 'pit cured', 'Ratnagiri method' 'Colombo cured' etc. established their markets in many parts of the world especially the Far Eastern countries and Ceylon. There was indeed a gradual fall in the trade in this commodity during the past few years. Even now the fish curing industry of India goes side by side with the modern processing industries like canning and freezing and is the most widely practised fish preservation technique in the country. The products are exported at present to countries like Ceylon, Singapore, Malaysia, African countries, U. K., U. S. A. etc.

The fish curing industry of India is one which has not taken the results of technological investigations for its benefit. The result is that the industry is still in its age-old condition with regard to methods of processing and quality of the products.

Reddening caused by halophillic bacteria and growth of molds popularly known as "dun" constitute the main types of spoilage in cured fish under tropical conditions as in India. Fish cured by the wet or dry curing method under normal conditions keep only for a period of about 2-3 weeks. By this time the above types of spoilage set in and make the product unacceptable.

With the experience gained from the field and as a result of experiments carried out with propionic acid and its sodium salt, this Institute has now evolved a simple but effective method of treatment with the chemical sodium propionate for the preservation of cured fish products. The method is mentioned below.

Except for the treatment with the preservative in the improved method suggested here there is no variation from the usual methods of curing. The fresh fish can be processed into cured products according to the usual procedure taking as much care as possible about the sanitary conditions. Market samples can also be treated by the method, but in this case the shelf-life of the product may not be as good as those products freshly processed and treated.

Method

When the finished product is ready for packing, sprinkle it with an intimate mixture of 3% sodium propionate in powdery refined salt.

In the case of wet cured products the proportion of the preservative can be reduced to 2% level.

After the application of the preservative mixture pack the products as usual in good containers. Containers lined inside with polythene paper are more effective to prevent further exposure to contamination and also to prevent excessive dehydration of the product.

It is roughly assessed that 10 kgs. of the cured product will require about 1 kg. of the preservative mixture. This proportion need not be strictly followed; however, it is essential that the mixture is uniformly dusted on the entire surface of the cured fish.

Prior to cooking, the treated fish may be rinsed in a little running water to wash away the adhering preservative and it can then be soaked in fresh water as in the usual way.

It has been observed that dry-cured product preserved by the mixture of sodium propionate in refined salt as mentioned above will keep for a period of 9 to 12 months free from fungal attack by the "red", whereas the normal storage life of dry-cured product is only about 8 weeks. Wet cured product treated by the preservative mixture has been found to keep well for 3 months as against 2 weeks in the case of untreated sample.

It seems desirable to mention in brief the advantages of cured products:

1. The method is safe, simple and easy to practise even by the fishermen.
2. The storage life of the treated products is extended considerably.
3. As the preservative is in the dry form and acts only superficially the chance of imparting undesirable flavour to the product is very much limited.
4. The cost of treatment is reasonable provided the chemical is made available at duty free rate.

Canning sardine-'natural pack'

Oil sardine *(Sardinella longiceps)* is the most important fishery of India in terms of volume. Even though canned sardines are popular throughout the world the Indian contribution is practically nil. Irrespective of having an installed capacity for producing over a lakh of cans of sardine per day in the country the annual production has been very meagre and has been entirely for the domestic market.

Among the reasons why India could not compete in world market for selling canned sardine are very high costs of containers, filling medium etc. Overseas packs are mostly in olive oil, sauces etc. and the cantainers popular are aluminium cans of 'pull tab' or 'lift tab' type which are not available in India.

After extensive research on turning out a canned product from sardine with extremely good organoleptic characteristics vis - a - vis reducing the over all cost of production the CIFT has evolved a method of canning sardines in which the fish is packed in its own juice. The method is simple and effects saving in the costly filling medium and also labour.

Process

1. Clean the fish after removing the head, gills, guts, scales etc. and wash thoroughly.
2. Dip in 15% sodium chloride solution containing 1% each of citric acid and potash alum for 15 minutes.
3. Drain the fish and pack in quarter dingly cans, 106 g. / can.
4. Exhaust the cans in an exhaust box for 10 minutes and seam immediately.
5. Heat process the cans in a retort at 1 kg. / sq. cm. steam for one hour.
6. Cool the cans immediately after processing to below 37°C. Wipe outside dry.

Prawn wafers

Prawn wafer is a product that can be prepared from minced prawn meat mixed with starch and other ingredients in suitable proportions, steamed and then dried after cutting into desired sizes and shapes. When fried in edible oil the product swells up and becomes very crisp. It has got the characteristic odour of prawns.

This Institute has worked out a method for preparation of prawn flake. The sample prepared by the method was found to contain protein 15 - 20% and was satisfactory as regards texture, flavour and keeping quality. An outline of the method developed is as follows:

Composition:

Cooked prawn meat* (cooked in 7% boiling brine for 4-6 minutes)	:	2 kg.
Corn flour	:	1 kg.
Tapioca starch	:	2 kg.
Common salt (refined)	:	50 gm.
Water	:	3.5 litres

1. Homogenise the cooked prawn meat with 1 litre of water for 10 mins. in a mechanical grinding machine.
2. Add the corn flour, tapioca starch and salt and rest of the water and blend the whole mass for one hour.
3. Spread the homogenised mass uniformly in aluminium tray in a thin layer of 3-4 mm. thickness and cook in steam for 10-15 mins.
4. Cool to room temperature.
5. Cut the layer into desired shapes and dry under sun or preferably in an artificial dryer (at 45°C to 50°C) to moisture content below 10%.
6. Pack suitable lots of the dried product in sealed polythene bags or glass bottles and store in a cool and dry place till marketing.

Permitted food colours can be incorporated if needed at the time of mixing the other ingredients with the blended prawn to get the desired colour.

Generaly, this type of product is used as side dish.

* Canned prawn meat rejected during pre-shipment inspection for reasons other than spoilage and non-edibility can well be processed into prawn wafers. If any metallic taste is detected in such material, wash it twice in hot water before homogenising with water Fish wafers can be prepared by taking in place of prawr similar quantity of cooked fish meat.

Soup powder from trash fish

The landing of miscellaneous varieties of fish and fishes of the type sole, silverbelly, anchoviella, sciaenids etc., which are generally considered as trash fish, is estimated to be about 2 lakh tons during 1969 constituting about 20% of the marine fish landings in India. Though edible in all respects, they are considered trash since they are relatively small in size and are not comparable to the common food fishes in quality and hence do not find ready market in fresh form. Such fish are sometimes even wasted due to lack of means for economic utilisation. Proper utilisation of the trash fish for human consumption is necessary not only in view of the acute shortage of protein rich foods in the country but also in view of paying better returns to those in the fishing industry.

The Central Institute of Fisheries Technology has tried the utilisation of trash fish for preparation of protein rich food products so that such products can either be used as side dishes or can be suitably incorporated in protein deficient foods to provide the dietary protein requirement. There is every possibility of such products becoming generally acceptable especially when they are of good flavour and can be easily prepared for consumption. One such product developed is good quality soup powder out of trash fish. Soup powders prepared from different food materials like vegetables, meat and egg are popular in different parts of the world. These dry products are rich in dietary constituents like protein, vitamins, fat and minerals. The soup powder prepared out of trash fish is also a rich source of animal protein and other nutritive factors. The method tried by this Institute for preparation of product is mentioed below.

Process

1. *Preparation of the material*

   Wash the fish in good water to remove blood, slime etc Remove the head, viscera and other waste parts. Wash thoroughly again.

2. *Cooking*

   Cooking the fish in an equal quantity of water for half an hour after adding about 2 drops of orthophosphoric acid for every litre of water so as to make the pH of water nearly 5.5.

3. *Pressing of the cooked meat*

   Press the fish taken in a canvas bag under a screw press. Remove the big pieces of bones, if any, after pressing.

4. *Re-cooking*

Disperse the press cake in equal quantity of water after adding orthophosphoric acid to the water as above and cook again for 15-20 minutes and press. Repeat the processes cooking and pressing once again. The press cake after the third operation can be used for preparation of soup powder. Repeated cooking and pressing remove a large amount of the volatile substances and fat which are responsible for the fishy odour.

5. *Blending of the press cake*

Disperse the press cake in about 1½ times its weight of water and blend the material in a waring blender.

6. *Incorporation of fried ingredients and re-blending*

Fry the onion and coriander in vegetable fat in quantities as shown in the composition given below. Pour the blend of cooked fish into it and again boil for about 10 minutes. Cool to room temperature and again blend in the waring blender.

7. *Drying*

Pour the whole mass in thin layer in aluminium trays and dry in an artificial dryer at about 70°C.

8. *Powdering and incorporation of other ingredients*

Powder the dried mass and add the other ingredients (starch, salt, skim milk powder, glucose, pepper, ascorbic acid, sodium carboxy methyl cellulose, sodium bisulphite and mono-sodium glutamate) and powder well to get a homogeneous product.

Packing

Pack the soup powder in air tight polythene lined aluminium foil bags or in cans.

Composition of ingredients

		(Weight in g.)	
Fish press cake	-	100	
Salt	-	26.6	
Fat	-	17 7	To be fried
Onion	-	166.0	To be fried
Coriander powder	-	2 2	To be fried
Starch (maida)	-	44 0	
Skim milk Powder	-	17.7	(as dietary supplement)
Glucose	-	8.8	(Sweetener)
Pepper	-	2.2	(as flavouring agent)
Ascorbic acid	-	0.22	(antioxidant)
Sodium carboxy methyl cellulose	-	0.44	(emulsifying agent)
Sodium bisulphite	-	0.22	(as preservative)
Monosodium glutamate	-	1.32	(flavouring agent)

The product prepared in the laboratory from thread fin bream (*Nemipterus japonicus*) contained protein 35.00% (on wet weight basis).

Preparation for cunsumption

The product can be prepared for table by boiling one part of it in 20 parts of water for 5 minutes.

Fish ensilage by fermentation method

Fish if suitably incorporated, is a good source of protein in cattle food. It will enrich the diet making up the protein deficiency and also will add to the mineral and vitamin contents. Fish ensilage is a form of fish protein that can be incorporated in cattle foods. A method of preparation of such a product reported earlier consists in adding an acid in the required level to the minced fish for preservation. Latter investigations to improve upon the quality of the product and to find out the possibility of producing the acid required for preservation in the medium itself instead of adding it directly proved that lactic acid produced by the fermentation of carbohydrates in the medium can be successfully used for the preparation of the product. The silage preserved by the lactic acid produced by fermentation is better in that the product is free from undesirable odour which it may have when prepared using mineral acids. Further, the product as such can be incorporated in cattle food (without neutralization of the acidity as is to be done in the case of product produced by using formic acid or mineral acids)

Molasses (a waste product of sugar industry) is used as the source of carbohydrate. Lactic acid is produced from molasses by fermentation with a pure culture of *Lactobacillus plantarum* NCIB 6105, an active homofermenter. The method worked out for preparation of silage is briefly described below:

Material

Any trash fish or fish unsuitable for direct human consumption. Non-fatty fish should be used since the presence of fish oil in the cattle food is undesirable.

Process

1. Wash the fish thoroughly and mince well in a meat mincer.

2. Mix the minced fish with 10% by weight of molasses. Make the whole material into a slurry by adding about 30% by weight of water. Cook the whole mass for about 20 minutes and then cool to room temperature

3. Take the mixture in a metal vessel coated inside with bitumen. (The bitumen coating is to resist the action of acid).

4. Add a pure culture (18-22 hrs. old) of *Lactobacillus plantarum* NCIB 6105 in the proportion of 5 ml. per 10 kg. of the material upto a maximum of 100 ml; thereafter the same quantity may be used for any quantity of the material. Stir well. Cover the vessel with a lid and then allow the fermentation to proceed at room temperature stirring the product occasionally.

5 The product obtained after about 72 hours is fish ensilage preserved by its lactic acid content.

6. When the digestion is over, distribute suitable lots of the product in well stoppered containers. The product keeps well for more than a year.

Precooking of the minced meat mixed with molasses and water hastened the digestion and the product could be obtained within 72 hours. The uncooked material as well can be used in which case a little more time will be taken for the fermentation to result in the production of lactic acid required to bring the pH to 4.5 for the preservation of the slurry. The pH of the sample prepared from uncookad material within the same time (72 hrs) will be about 5 which is less for proper preservation.

The silage prepared from jew fish was of light brown colour with fermented odour. The product at desired levels can be incorporated as such in cattle-food. The composition of a sample of silage prepared from jew fish is given below. The analysis data clearly indicate that the product is a rich source of protein, minerals and vitamins.

Protein	-	12.13%
Minerals	-	3.17%
Lactic acid	-	4.84%
Ether extractives	-	2.65%
Viamin B_{12}	-	23.46 μ g%
Thiamin	-	14.61 μ g%
Riboflavin	-	13.78 μ g%
Pantothenic acid	-	8.48 μ g%
pH of the sample	-	4.4

Shark fins and fin rays

Dried shark fin is a valuable product of export from India. Total export* of shark fins and fish maws together in 1972 has been 293.7 tonnes valued at Rs. 6.026 million. A major portion of the export takes place from Bombay although fins are processed in almost all the maritime States of India. Though fins from several varieties of sharks are exported, those ftom 'Ranja' (*Rhynchobatus djiddensis*) fetch the maximum price. Fins from 'Pisori' *(Scoliodon walbheemi)*, 'Khada' (*Carcharinus melanopterus)* and 'Kanar' (*Zygaena malleus*) are some of the other varieties exported. The fins are exported mainly to Singapore, Hongkong and U. K. At the importing countries the fins are processed for their fin rays which are utilised in soup preparations. If the fin rays are exported instead of fins, it may be possible to realise better prices and reduce shipping cost. Of late, it is known that there is good internal demand also for shark fin rays. especially in major hotels.

PROCESS FOR SHARK FINS

1. Cut the fins (spinal and caudal fins) from the big size sharks (of about 5ft. or more in length).
2. Remove the adhering flesh and wash thoroughly in fresh water.
3. Dust the fins with salt in the ratio 1:10, the cut portions being liberally sprinkled with salt. Alternately, dust the cut portion with little lime and salt. Set aside for 24 hours.
4. After spreading on mats to prevent admixture with sand and other extraneous matter, dry the fins in the sun to the desired degree (moisture content 7-8%).
5. Grade the fins according to species. colour and size.
6. Pack suitable lots in moisture proof containers such as polythene lined gunny bags.

EXTRACTION OF FIN RAYS

Both fresh and dried fins can be used.

1. In the case of dried fins, soak the material for 2-3 days in water acidified to pH 2.5 to 5 with acetic acid so as to hydrolyse the collagen in the fins to gelatin. If the muscle and skin do not get softened even on soaking for 2-3 days in acidic water (as in the case of shark fins stored for more than a year when the rehydration capacity is less) the period of soaking may be extended to 5-6 days.
2. Treat the fins (fresh or softened dry fins) in hot 10% acetic acid at 60°C for 1½ to 2 hours, depending on the size of the fins.
3. Scrape off the skin and rinse with water.
4. Heat again in fresh 10% acetic acid for about 1 hr.
5. Separate the rays from the flesh while washing with cold water.
6. Wash off the excess acid with water.
7. Collect the rays and dry under sun or preferably in an artificial dryer at 50-60°C (for about 4 hrs.) to a moisture content of 5-8%
8. Store the dried fins in polythene bags. Such fins will keep in good condition for more than a year without any significant change

* In export statistics, shark fins and maws are grouped together.

Chitosan from prawn shell waste

In the prawn processing industry, large quantities of shell and head are left behind as waste material. Considering the volume of export of frozen and canned prawns alone from the country, it can be roughly estimated that about 40,000 tonnes of these wastes will be available annually. At present, the head and shell wastes do not find any significant economic use. In some parts of the country they are used as manure either as such or after drying.

The Central Institute of Fisheries Technology has been engaged in finding out ways for economic utilization of the head and shell wastes for sometime now. Laboratory methods worked out for preparation of chitin and glucosamine hydrochloride from prawn shell and cholesterol from the fat content of the prawn head have already been reported. Now it is shown that prawn shells form a good raw material for preparation of chitosan, a valuable industrial chemical.

Process

1. Boil the prawn shell in about 3% solution of sodium hydroxide (quantity just enough to immerse the shell) for about 30 minutes. Drain off the solution and repeat the treatment with the residue Treatment with sodium hydroxide removes the protein content of the shells. Wash twice with water.
2. Treat the protein free residue with bleach liquor containing 0 3 to 0.5% available chlorine at room temperature for 1 hour. Wash two times with water.
3. Treat the bleached residue with 10% hydrochloric acid (commercial) at room temperature for 2 hrs so as to remove the calcium and phosphorous contents in the residue completely. Wash the residue free of acid which is almost pure chitin
4. Treat the chitin at 100°C with 1:1 solution of sodium hydroxide for 90 minutes. Wash with water to free it of the alkali and then dry to get the final product, chitosan The yield of chitosan is about 3% of the weight of the fresh prawn shell

Chitosan finds use as a sizing material for cotton, wool, rayon and other synthetic fibres It may also be used in the preparation of cosmetics and pharmaceuticals and also as a water clarifying agent. Chitosan dissolves easily in dilute solutions of organic acids to give viscous solutions. It can be precipitated by neutralizing the solution with alkali Recent trials conducted by the Institute in collaboration with the Cotton Technological Research Laboratory at Bombay have shown that treatment with chitosan under specified conditions is beneficial in giving a permanent organdie type finish to cotton fabrics and also in preventing shredding of jute.

Extraction of sardine oil

Sardine oil extracted by the existing commercial practice is generally of inferior quality with low storage life, undesirable colour and objectionable odour. During the fishing season many oil extraction units spring up all along the coast, but most of these would not be equipped to carry out the extraction on a scientific basis. Perhaps the very limited use of sardine oil must be responsible for this lack of interest on the part of the industry in adopting scientific methods.

Oil sardine constitutes nearly 20% of the total marine fish landings in India, average annual catch being of the order of 2,33,000 tons.

Assuming that about 50% of the total catch would be available for extraction of oil, the quantity that could be produced works out to about 11700 tonnes per year on the basis of an average oil content of 10% in the fish. But the quantity produced at present is much less.

Since sardine oil, after separation of the stearine, has been found to have characteristics similar to some important vegetable drying oils like linseed oil and thus have potential commercial application as a cheap substitute to them, the Institute as a first step concentrated its efforts on devicing a suitable method of extraction of high quality oil at little or no extra cost. The method recommended is:

1. As far as possible use only fresh sardine for extraction. Wash the material well.

2. Take water in the vessel used for extraction in the ratio of 1 part of water to 1 part of fish (by weight). Boil the water. (Aluminium or tinned copper vessels are suitable for extraction of the oil).

3. Add fish to the boiling water and continue the boiling till the oil gets separated at the top. Stir occasionally while boiling.

4. Collect the separated oil by means of spoons or trays.

5. Cook again for about 30 minutes with occasional stirring. Allow to settle. Collect the supernatent liquid and keep separately.

6. Take the cooked material in canvas bag, press under a screw press and collect the press liquor. Mix the press liquor with the supernatent liquid collected before.

7. Add sufficient quantity of common salt to the oil-water mixture to break the emulsion. Collect the separated oil and mix with the sample of oil collected earlier.

8. Heat the oil on a water bath to remove the last traces of water.

9. Store suitable lots in containers.

The characteristics of the oil extracted by the improved method are given below. For comparison the characteristics of samples of commercially available oil are also given.

	Oil prepared by the improved methed	Commercially available oil
Physical characteristics		
Colour	Lemon yellow to yellow	yellow to black
Clarity at room temperature	Clear	Turbid to Clear
Odour	Characteristic of the oil	Rancid/ Putrid odour
Chemical characteristics		
Saponification value	192-195	192-193
Iodine value	152-175	139-161
Peroxide value	0.32-2.7	0.4382-7.2
Unsaponifiable matter	0.82-1.15	0.84-1.55

The oil prepared by the method besides having marked improvement in quality in many ways, keeps well for one year (or even more) without significant changes in the analytical characteristics. This is important since any industry that may utilise the oil will require a constant supply Since the extraction is seasonal a constant supply can be ensured only if the oil can be kept in good condition at least till the ensuing fishing season.

Maintenance of wooden fishing boats

For obtaining long and trouble free service from fishing boats, adequate care has to be taken in their proper maintenance at regular intervals, at least once a year. Under monsoon conditions fishing is mostly irregular. This time is most opportune for boat-owners to attend to the maintenance of hull and machineries so that the boat is in a thoroughly fit condition to go into action as soon as fishing conditions improve. Further it may not be possible to check and attend to certain of the major repairs when the boat is afloat. The suggested schedule for hull maintenance is as follows:

1. Before hauling the boat ashore, remove mast, derricks, stay wires and all other heavy items of removable stores including ballast. The boat has to be made as light as possible and carefully hauled ashore.

2. The boat should be kept off the ground sufficiently high to permit free air movement underneath as well as in and around them. Care has to be taken against the possible attack of white ants. This can be done by providing metal shields in the keel blocks and other supporting structures. The boat should be protected from sun and rain.

3. Remove all the bottom foulers on the hull with a sharp metal scraper when they are still wet (when they dry up it is rather difficult to scrape them off). Scrape off fhe "algal belt" seen just above and below the water-line.

4. Examine the hull sheathing carefully, particularly at the stem, keel and rudder. If the hull has been leaking before, the sheathing has to be removed at such places. The seams and joints have to be checked, recaulked and properly filled with 'putty'. The sheating should extend 15 to 22 cm. above water line both forward and aft.

5. Look for marine borer holes, if any, and fill them with wooden plugs or with any good seaming compound. If the damages are great, it is advisable to replace such members without fail.

If the caulking material has been eaten away at the seams of the hull planks, better renew them in the conventional manner either using treated cotton threads or 'oakum' and fill up with a suitable seaming compound like white putty, CNSL resin or the special polyester seaming compound as has been recommended by this Institute.

The entire wooden hull below water line should receive two or more coats of coal tar or its derivatives like creosote. In between the coated wooden hull and the metal sheathing a thick layer of insulation of tar felt underlay is always recommended. The metal sheathing in convenient lengths will have to be firmly fixed on to the hull using the recommended type and quality of fastenings It is very essential not to allow any voids in between the sheathing and the insulation. *For copper sheathing work, use only copper tacks and not of iron, G. I. or aluminium. With aluminium sheathing use only aluminium alloy fastenings-screws or tacks.*

While copper sheathing does not require any further coat of anticorrosive or antifouling paint under normal circumstances, aluminium and FRP sheathing requires painting as per the schedules recommened by this Institute. The schedules are given below for ready reference

Painting schedules recommended for the hull below waterline of wooden fishing boats

	Details	Copper sheathing	Aluminium sheathing	F. R. P. sheathing
1.	Etching primer to ensure better adhesion of the subsequent coats	Not necessary	Essential on both the sides of new aluminium sheets.	Necessary only on the exposed surface.
2	Anticorrosive paint	Not necessary	Two coats of zinc chromate paint on both the sides of the sheathing or one coat of zinc chromate and one coat of epoxy coal tar.	Not necessary
3.	Antifouling paint for preventing the settlement of the marine fouling organisms. (Plants and animals)	Normally not necessary but recommended for old sheets	Two coats of any good quality antifouling paint which will give about 8 to 10 months of fouling free life.	Two coats of antifouling paints as for aluminium alloy sheathing.

N. B. During the annual hauling, if bare metal of the old sheathing is exposed, renew the anticorrosive and antifouling paints as recommended. Launch the boat when antifouling paint is still wet and tacky. Never allow it to dry completely

6. Leaky decks are responsible for rapid deterioration of the internal timber structures. Rake out the deck plank seaming compounds that have become brittle and fill them with fresh compounds after re-caulking, if necessary. Frequent application of any good oil (linseed oil or poon oil) keeps the deck planks free from splitting and weathering.

7. After thoroughly cleaning the inside of the hull, check the frames, shelves, beams, stringers and bulk-heads for the presence of 'Dry-rot'. Pentachlorophenol or copper chrome arsenic compounds can be used as wood preservatives. Good ventilation inside the hull is absolutely necessary. Fish-hold must always be kept clean in a most hygienic condition with the frequent application of suitable disinfectant.

8. Above water-line on the outside hull, scrape off all old paint, thoroughly clean and allow it to dry. Wooden structures recently renewed should receive two coats of any good quality wood primer. Give two uniform finishing coats of good quality top coat wood-paint of any desired colour There is no need to paint the inside of the hull as it would slow down the drying of the wet wood particulary at the bilges. All ferrous structures should be thoroughly chipped, brushed and cleaned to remove rust and mill scale. The choice and application of priming paint is the most important factor. Red lead and zinc chromate are good rust inhibitive primer paints and over them good quality finishing paints have to be given. Painting of ferrous structures should be attended to at regular intervals depending on the intensity of corrosion.

9. Check up all external fastenings at all assembly points for slackness and corrosion. Badly corroded fastenings should be replaced at all costs. Bimetallic contacts have to be carefully avoided. Rudder and stern gear fittings have to be thoroughly checked for possible failures. *Check the sea-cock and engine bearer bolts without fail.*

10. Damaged propellers and major rapairs to the main engine and other machineries should be left for attention under competent hands. Minor dents on the propeller blade edges can be cleaned up with a file and finally with emery paper. Excessive wear of the propeller blades may be due to galvanic action and as such no metals of greatly different potentials should be in the vicinity of the propeller. Cathodic protection can be ensured by providing sacrificial zinc blocks (Electrolytic zinc only) at appropriate places near the propeller on the stern post or rudder.

Unprotected wooden structures will rapidly deteriorate due to biological agencies. Unprotected metallic structures will corrode and wear out rapidly. Hull sheathing may be damaged due to abrasion or running aground. So it is essential to check these items carefully from time to time. Boats well cared for and well maintained last longer and serve better without break-downs.

Aluminium alloy sheathing for wooden hulls of fishing boats

In the tropical waters of India the damages caused by marine borers and foulers to unprotected wooden hulls of fishing boats are comparatively very high. Marine fouling organisms settling in large numbers on the underwater portion of the hull increase the frictional resistance with a consequent reduction in the normal speed of the vessel. Marine borers attack the unprotected wooden planks of the hull by boring deep into them thereby weakening them. Many protective measures to ward off or to minimise the menace of these organisms are in vogue.

Copper, the toxic heavy metal, is used in the form of rolled sheet for the protection of wooden hulls from foulers and borers very effectively.

The indigenous resources of copper being very much limited, most of our demands are met from imported stock. Due to the increase in use of copper for various other important industrial purposes, its limited supply and import restrictions, the price of copper of late has increased considerably. The industry finds it very difficult and expensive to use copper sheets for fishing boats because it adds to the cost of boat considerably. This has necessitated a search for a cheap and effective substitute for copper. Experiments conducted at the Central Institute of Fisheries Technology have revealed that copper sheets can be substituted very effectively by aluminium alloy sheets (Aluminimum 97% and magnesium 2%) that are now manufactured in India out of indigenous raw materials.

On an experimental measure, aluminium-magnesium alloy sheet was used first on the 9.14m (30 ft.) prototype fishing boat of the Institute, FISHTECH No. V in 1963, and the boat has been in regular fishing operation for about twelve years now. Encouraged by the performance of the sheathing on this boat two numbers of 15.24 m. (50 ft) (FISHTECH No 8 and 'SINDHUKUMARI') multipurpose fishing vessels and a 9.75 m. (32 ft.) gillnetter (FISHTECH No 9) were also sheathed with the special quality aluminium alloy. A few other departmental wooden vessels which originally had copper sheathing were also sheathed with aluminium alloy subsequently. The aluminium alloy sheets in these boats have been free from major breakdown due to corrosion. If proper materials are used and routine annual maintenance is adopted as per recommended procedures there will be very little replacement of the sheathing required year after

year. Under such conditions the original sheathing is likely to last for nearly 4 to 5 years. A number of wooden fishing vessels, sailing crafts and barges have now been sheathed with aluminium sheathing in lieu of copper.

It is very economic to use aluminium alloy sheets for sheathing due to their lightness and low price. The cost of aluminium sheathing is less than 50% of the cost of sheathing with copper.

Specifications for the Materials

Aluminium-magnesium alloy similar to NS5 of Indian Standards Institution or INDAL M57S or HINDAL 5052 containing not less than 2% magnesium is recommended. The sheets should be of thickness 20 or 22 SWG and of soft or $\frac{1}{4}$ hard temper.

Use aluminium screws of $\frac{3}{4}$" x 6 or aluminium tacks of $\frac{1}{4}$" and 1" for planking of 1" thickness. At the instance of this Institute suitable aluminium tacks from aluminium alloy of the specification 'M54-S' corresponding to IS: 737: 1955 NS5 are now being manufactured indigenously. These are found to be quite suitable for use with aluminium alloy sheets of the specification given earlier. These tacks can be used in the same manner as the copper tacks used on copper sheets.

Aluminium alloy is prone to corrosion in sea water when the metal's natural protective oxide film is damaged and when its self repair is prevented by chemical dissolution of the oxide. The sheathing with aluminium alloy is therefore to be protected by proper painting. Paints required are: (1) etching primer (2) anti-corrosive paint (zinc chromate primer or epoxy coal tar) (3) antifouling paints.

Method of Sheathing

The part of the hull to be covered with aluminium sheets should be properly planed. The holes made for nail heads and bolt heads should be filled with white putty or any seaming compound. The hull then should be sandered and given a single coat of tar on it. Tar felt underlay should be fixed over this as in the case of copper sheathing. Another coat of tar should be applied over the tar felt underlay. The aluminium alloy sheets should then be fixed over this in the usual way either with aluminium screws or tacks. The quarter hard aluminium alloy sheets will render pliability and easy working. Aluminium tacks are considered to be the best for permanently fixing the sheets to the hull. But if aluminium tacks are not easily available aluminium wood screws can also be used. *In no case copper, brass or metallic fastenings other than those of aluminium should be used.*

For fixing aluminium wood screws predrilling is necessary. Care should be taken to use drill bits of proper diameter. The screws may break if the predrilled holes are small and screws will not hold if the holes are big. The holes should be drilled with great care so as to be just right. A little counter sinking for accomodating the screw head is necessary. Utmost care should be taken to see that the depth of the counter sinking does not exceed a particular limit. If it is too much the sheathing may come off over the screw heads. The screws should be fixed 7.5 cm. apart both horizontally and vertically.

The labour requirement for sheathing the hull is normally 11.8 man hour per

sq.m. for aluminium sheathing with screws and 2.6 man hour per sq. m. for aluminium tacks and is same as for copper.

Important do's and dont's for Aluminium Sheathing

1. The sheathing should not be in contact with any other metal part on the hull. All fastening holes on the hull planking should be carefully closed with a suitable seaming compound.
2. A good coat of coal tar should be given on the hull below waterline after necessary sandering and a layer of tar felt underlay should be fixed.
3. Bronze or brass fittings should be avoided. In cases where this cannnot be avoided, care should be taken to see that there is no direct contact between the metals. This can be accomplished by rubber or wooden pads in between the surfaces of these metals.
4. The keel shoe, rudder forks, rudder shafts and housing should be of either cast iron or mild steel.
5. If metallic contacts are suspected provide chemically pure zinc blocks (99.95% as per I. S. 209) as a measure of cathodic protection. Zinc blocks should be insulated from the aluminium sheets by means of wooden or rubber pads between them. The cathodic protection must be very efficient at the stern quarter where different metals come in close proximity-

Fouling is comparatively more on the aluminium alloy sheathing than copper. This can easily be overcome by adopting the proper painting schedule as recommended.

Painting schedule

Sander the surface of the aluminium sheet so as to remove the sharp and rough edges of screw heads and to provide a somewhat rough surface to hold the paint or give a coat of etching primer. Then apply two coats of zinc chromate primer and allow it to dry. Over this apply two coats of commercial antifouling paint. The second coat of the antifouling paint should be applied only 8 to 10 hrs. before launching of the boat. Recent researches have shown that one coat of zinc chromate metal primer followed by one coat of epoxy coal tar and one coat of antifouling paint on the outside surface of the aluminium sheathing enhances the life of the sheathing. *Do not apply antifouling paint directly on the aluminium sheathing without a barrier coat of zinc chromate primer.*

In order to enhance the corrosion resistance of the inside surface of the aluminium sheathing it is necessary to paint that surface also. The usual coating of etching wash primer followed by two coats of zinc chromate primer and epoxy coal tar should be given to the *inside surface* as is done on the outside surface. Antifouling paint need be given only to the outside surface that comes in contact with sea water. If the inside surface of the aluminium sheathing is not painted, after initial resistance, the surface will yield to the corrosive elements of sea water once the oxide film is lost.

If proper painting schedule is adopted and cathodic protection installed, there cannot be any adverse effect on the regions of the hull where different metals come in close proximity. Annual dry docking, cleaning and painting of the underwater surface should be strictly observed. Whenever sheets are renewed follow the painting schedule in full.

Fibreglass reinforced plastic sheathing for wooden fishing boats

The use of Fibreglass Reinforced Plastics (FRP) in boat building industry has increased considerably over the last few years in many countries, particularly for the construction of "All Plastic" fishing boats. In India at present only small row boats and pleasure crafts and a few fishing crafts built out of FRP have come into use and are slowly becoming popular, while there is plenty of scope for popularising FRP fishing trawlers specially for mass production of the standard designs.

Method of Sheathing Boat Hulls

1. The entire wooden hull must be completely dry (very low moisture content) and free from oil, grease and oily preservatives. From the hull planks of old boats oil, grease and tar, if any, have to be completely removed using suitable solvents or a metal scrapper. Sander well if necessary. Oily surfaces will not hold the FRP.

2. The plank seams and bolt holes should not have the conventional caulking cotton and white putty but instead a special seaming compound has to be made and used by mixing activated resin and any of the fillers like *calcium carbonate*, *silica*, sawdust or *titanium dioxide*. The seaming compound should be allowed to dry fully before sheathing is attemped.

3. The wooden surface of the hull to be sheathed has to be sandered with coarse abrasive paper since only such a rough surface will have a better holding power for the resin and the following layer of glassfibre.

4. Apply by brush one generous coat of activated polyester resin over the wooden surface to be sheathed. Porous woods will absorb some resin and hence supplement the resin by a further coating. For every kg. of fibreglass, take 2 kg. of polyester resin and for every kg of resin take 10 to 15 g. of accelerator and catalyst depending on weather conditions. A lesser quantity of accelerator and catalyst are recommened under very hot climatic and open air conditions.

5. When the resin is still tacky on the hull, lay upon it the fibreglass chopped strand mat that has already been cut to suitable size and shape. Apply the activated resin over the mat and work with the brush for the proper impregnation of the resin into the chopped strands. If necessary use hand rollers up and down, pressing the resin soaked glass mat on the wooden surface. Level off

the excess resin using a rubber "squeege". Thus complete the first layer of FRP throughout the hull allowing full 1 to 2 inch overlapping wherever necessary at all joints of the mat. No area of glass mat should remain without the resin. Avoid air bubbles and bloating. If seen, rupture them and re-do the sheathing on that spot. Allow the surface to dry. When slightly tacky, lay up the second layer of fibreglass mat and work up with the activated resin as before. If necessary, special predispersed colour pigments or fillers can be used with the final coat of activated resin (mix pigments or fillers before the catalyst is added). The final coat of resin gives the surface a smooth finish. Once the desired number of layers of fibreglass mat has been built up, allow the surface to dry and cure completely. In about 10 to 15 days of post curing the surface will become very tough, dry and hard. 2 layers of fibreglass chopped strand mat of 450 g./m^2 has given adequate protective sheathing as good as, if not far better than, copper or aluminium sheathing. More layers may be necessary only under special circumstances.

6. On the dry surface of the FRP sheathing use a chemical etchant or coarse sand paper so that the sheathing will tenaciously hold any further coat of painting. Being a non-toxic surface, FRP sheathing will gather all the marine fouling organisms on them under continuous immersion in sea-water

7. Use one or two coats of good quality marine antifouling paint 8 to 12 hours before launching. Once launched, the vessel need be hauled up again after a year of service to renew the antifouling paint. On the slipway, scrape the fouling settlements on the hull, if any, and allow the surface to dry completely. Check for any delamination or damages to the sheathing in that area and re-do the patch work in the same way the original sheathing was done. FRP surfaces can be easily drilled for fixing fastenings and any fittings. By any chance the wood below the sheathing is damaged by mechanical means, replace the damaged part and resheath that area alone with FRP following the standard procedure. As a result of these prototype studies, it has been estimated that the 2 layers of FRP lamination as per the standard schedule would cost round about Rs. 100 per square metre. However the cost may vary according to the type of glass fibre, (woven roving surface mat etc.,) resin used (isopthalate, orthophthalate etc ,) number of layers adopted and also fillers and pigments incorporated.

Dissemination of research findings in the fields of operation is as important as the research itself. CIFT has done this, besides other means, through numerous scientific, technical and other papers in different publications in the country and abroad.

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Name of publication	Year	Price
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32 ft. power shrimp trawler / gill netter	1964	4.15
36 ft. power shrimp trawler / gill netter	1964	4.55
42 ft. multipurpose power fishing vessel	1964	3.05
An account of the inland fishing gear and methods of India	1971	10.37
Research in fish behaviour - A review	1973	Non price
A mechanical device for removal of submerged aquatic weeds	1971	Non price
12 years fisheries technological research	1972	Non price
Fish Technology Newsletter Vols I - X	1960 to 1970	Non price

"Give a man a fish and you will assuage his hunger for a day. Teach him to fish and you will assuage his hunger for ever".